Unit - IV
LOCOMOTION AND REPRODUCTION IN PROTOZOA

SYNOPSIS

- 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 organism 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 orgenelles 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 drag 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***.

LOCOMOTION IN PROTOZOA

LEVEL - I

1. Locomotion in influenced by
   1) External stimuli only 2) Internal stimuli only
   3) Both 1 & 2 4) Environmental factors
2. Myonemes helps in locomotion in
   1) Euglena 2) Sporozoans
   3) Amoeba 4) Euglena sporozoans

LOCOMOTARY STRUCTURES IN PROTOZOA

3. Locomotor organelles in unicellular organisms.
   1) Pseudopodia, flagella, cilia, parapodia
   2) pseudopodia, flagella, cilia
   3) Pseudopodia, flagella, cilia, setae
   4) Pseudopodia, flagella, cilia, tube feet
4. The structures that assist in locomotion in protozoans
   1) Myonemes 2) Coiled filaments
   3) Reticular fibres 4) Ergastic substances

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 - Eg : **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**
- Pseudopodia 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**
- Reticulopodia are also called - **Myxopodia**
- Primary function of Reticulopodia 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 **- Heliozoans (Actinosphaerium, Actinophrys) and Radiolarians (Collozoum)**

PSEUDOPODIA

LEVEL - I

5. Temporary outgrowths of cell which are formed on the surface of the body of the movement of cytoplasm
   1) Pseudopodia 2) Cilia
   3) Flagella 4) Myonemes
6. Which of the following is monopodial form
   1) Amoeba 2) Entamoeba
   3) Mastigamoeba 4) Plasmodium
7. Amoeba proteus is
   1) monopodial protozoan
   2) polypodial eumetazoan
   3) polypodial protozoan
   4) monopodial protozoans
8. A mastigophoran with pseudopodia
   1) Amoeba 2) Euglena
   3) Matigamoeba 4) Monas
9. Pseudopodia are the characteristic of "super class"
   1) Rhizopodea 2) Actinopodea
   3) Sarcodina 4) Myxopodea
10. Locomotion by pseudopodia is called
    1) rolling movement 2) flowing movement
    3) Amoeboid movement 4) euglenoid movement
11. The pseudopodia of Amoeba are important for
    1) Feeding 2) Offence and defence
    3) Locomotion 4) Locomotion and feeding
12. The type of pseudodia in Entamoeba
    1) Lobopodia 2) Filopodia
    3) Actinopodia 4) Reticulopodia
13. Blunt finger like tubular pseudopodia containing both ectoplasm and endoplasm are
    1) Lobopodia 2) Filopodia
    3) Reticulopodia 4) Actinopodia

LEVEL - II

14. Identify the correct answer :
    Statement (S) : Mastigamoeba is a sarcomastigophore.
    Reason (R): It shows both pseudopodia and flagellum
    1) Both S and R are true but 'R' is correct explanation to 'S'
    2) Both S and R are false
    3) Only S is ture but 'R' is false
    4) Both S and R are ture but 'R' is not the correct explanation to 'S'
15. One of the following is not related to pseudopodia
    1) These are the locomotor organelles in protozoans
    2) These are permanent structures
    3) These are formed from the surface of the cell
    4) One to many pseudopodia may be formed

FILOPODIA

LEVEL - I

16. Pseudopodia formed from only ectoplasm
    1) reticulopodia 2) Filopodia
    3) Actinopodia 4) Axopodia
17. Slender filamentous psuedopodia with pointed tips, tapering from base to tip, are
    1) Filopodia 2) Actinopodia
    3) Axopodia 4) Reticulopodia
18. The type of Pseudopodia in Lecithium
    1) Actinopodia 2) Lobopodia
    3) Axopodia 4) Filopodia

RETICULOPODIA

LEVEL - I

19. Filamentous, branched and profusely inter connected to form a net work like pseudopodia
    1) Actinopodia 2) Myxopodia
    3) Lobopodia 4) Filopodia
20. Reticulopodia are commenly present in
    1) Foraminiferans 2) Sun animalcules
    3) Plant animalcules 4) Radiolarians

LEVEL - II

21. Function of reticulopodia
    1) primary function is locomotion and secondary function is ingestion
    2) Primary function is ingestion and secondary function is locomotion
    3) only locomotion 4) only ingestion
22. Find out the wrong matching
    1) Lobopodia - Entamoeba
    2) Filopodia - Euglypha
    3) Reticulopodia - Arcella
    4) Actinopodia - Collozoum

AXOPODIA

LEVEL - I

23. Axopodia occurs in
    1) Heliozoans 2) Radiolarians
    3) Both 1 and 2 4) Foraminiferans
24. The chief function of Axopodia is
    1) Locomotion 2) Anchoring
    3) Help in mating 4) Food collection
25. Which type of pseudopodium contains a central axial rod surrounded by granular and adhesive cytoplasm
    1) Axopodia 2) Filopodia
    3) Rhizopodia 4) Lobopodia

LEVEL - II

26. Find out the correct matching
    1) Axopodia - Actinopodia
    2) Reticulopodia - filamentous unbranched
    3) Filopodia - Filamentous, branched pseudopodia
    4) Lobopodia - tappered pseudopodia

FLAGELLA

- Flagella are the locomotor organelles of **- the mastigophore protozoan**
- Flagellum consist 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) kinetosome**
- 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**

ULTRA / STRUCTURE OF FLAGELLUM

- The central axial filament (or) axoneme of flagellum shows **- 9 + 2 arrangement**
- The two central logitudinal tubules are enclosed by **- inner sheath.**
- Two central singlet microtubules are surrounded by **- Nine peripheral "doublets".**
- Nine peripheral doublets form a **-Cylinder**
- The doublets 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**
- 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**
- Flimmers are - **solid and 5 nm thick**
- Mastigonemes are - **tubular and 20nm thick**
- If mastigogemes are not present on a flagellum and 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 mastigonomes are in two or more rows along the length of the axoneme, it is - **Pantonematic type Eg : Peranema, Monas**
- If, mastigenemes are in two or more rows along the length of flagellum and ends as naked axial filament- **Pantacronematic type Eg : Urceolus**
- If the flagellum is simple without flimmers and terminal naked filament is - **Anematic type (simple) Eg : Chilomonas, Cryptomonas**

FLAGELLA

Level - I

27. Locomotary organells in mastigophorans
    1) Cilia 2) Flagella
    3) Pseudopodia 4) Myonemes
28. Long stiff axial filament of flagellum is
    1) Axoneme 2) Mastigoneme
    3) Myoneme 4) Flimmers

29. Axoneme arises from
1) Nucleus 2) Basal granule
3) Nucleolus 4) Stigma
30. The number of flagella in Trypanosoma
1) 1 2) 3
3) 2 4) 4
31. The number of flagella in Euglena and Dinoflagellats (ceratium)
1) 1 2) 2
3) 3 4) 4
32. The number of flagella in Trichomonas
1) 1 2) 2 3) 3 4) 4
33. The number of flagella in Giardia
1) 1 2) 2
3) 3pairs 4) 4 pairs
34. The number of flagella in Trichonympha
1) 1 pair 2) 2 pairs
3) 3 pairs 4) Many
35. Two flagella are parallal and unequal in
1) Euglena 2) Trichomonas
3) Trichonympha 4) Giardia
36. Flagellum arises at the posterior end of the body in
1) Euglena 2) Trichomonas
3) Trichonympha 4) Trypanosoma

ULTRA STRUCTURE OF FLAGELLUM
LEVEL - I

37. Inner sheath of flagellum is present around
1) peripheral doublets 2) central singlets
3) triplets of basal granule 4) outer to flagellum
38. Microtubules present outer cylinder of flagellum
1) 18 2) 9
3) 2 4) 20
39. The arms of microtubules attached to outer doublets are made of
1) Flagellin 2) Tubulin
3) Dynein 4) Fibroin
40. One of the following is not related to flagellum
1) Innersheath 2) Flimmers
3) Outer sheath 4) Plasmagel tube
41. Triplets are related to
1) Basalgranule of flagellum
2) Gel tube of pseudopodium
3) Inner sheath of cilium
4) Central microtubules of flagellum
42. Radial spokes of flagellum connect
1) Doublet of flagellum to inner sheath
2) Triplets of basal granule to inner sheath
3) Doublets of flagellum to outer sheath
4) Triplets of basal granule to outer sheath

TYPES OF FLAGELLA
LEVEL - I
STICHONEMATIC

43. Flagellum with one row of lateral appendages occur on the axoneme upto the tip is
1) Stichonematic 2) Pantonematic
3) Pantacronematic 4) Anematic
44. Stichonematic flagellum is present in
1) Urceolus 2) Polytoma
3) Monas 4) Astasia

PANTONEMATIC

45. Flagellum in which lateral appendages are present on the axoneme on two or more rows
1) Stiochonematic 2) Pantonematic
3) Pantachronematic 4) Anematic
46. Pantonematic flagellum is present in
1) Euglena 2) Monas
3) Polytoma 4) Urceolus

ACRONEMATIC

47. Flagellum in which lateral appendages are absent and axoneme ends as a terminal naked axial filament is
1) Stichonematic 2) Acronematic
3) Pantonematic 4) Pantachronematic
48. Acronematic flagellum is present in
1) Polytoma 2) Urceolus
3) Monas 4) Astasia

PANTACHRONEMATIC

49. Flagellum provided with two or more rows of lateral appendages and axoneme ends in terminal naked axial filament is
1) Stichonematic 2) Pantonematic
3) Acronematic 4) Pantacronematic
50. Pantachronematic flagellum is present
1) Monas 2) Astasia
3) Polytoma 4) Urceolus

LEVEL - II

51. Both mastigonemes and terminal filament are present in
1) Stichonematic flagellum
2) Acronematic flagellum
3) Pantonematic flagellum
4) Pantacronematic flagellum
52. Only terminal filament is present in one of the following
1) Peranema 2) Euglena
3) Urceolus 4) Polytoma

53. Find the wrong matching
1) Stichonematic - Euglena
2) Acronematic - Chlamydomonas
3) Pantonematic - Peranema
4) Anematic - Monas

54. Find out the correct matching
1) Stichonematic -only one row of mastigonemes
2) Chilomonas - Mastigonemes on either side of axoneme
3) Pantonematic - One row of mastigonemes
4) Polytoma - both mastigonemes and terminal filament on axoneme

CILIA

- Short but highly vibratile organelles in large numbers on the body of protozoans are **- Cilia**
- Cilia are found in **- Ciliate protozoans**
- Cilia are locomotary organelles, throughout their life in the class **- Ciliata**
- Primitive form like holotriche is **- Paramecium**
- The advancend form like peritriche 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 arrangement of microtubules in the Basal granule is **- 9+0(Triplets)**
- 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**

DIFFERENCE BETWEEN FLAGELLA AND CILIA

- Flagellum length is **- 150 μ**
- Cilium length is - 5 *to* 10μ
- 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 6 or 8 or many**
- More number of flagella present in - **Trichonympha**
- Cilia are generally **-more in number**

CILIA

LEVEL - I

55. Holotrichs is
1) Vorticella 2) Paramecium
3) Amoeba 4) Polytoma

56. Peritriche is
1) Vorticella 2) Paramecium
3) Amoeba 4) Polytoma

57. Holotriches mean
1) Ciliates with cilia all over the body
2) Ciliates with cilia around oral disc
3) Ciliates with cilia only in young stages
4) Flagellates with flagella all over the body

58. One of the following is a ciliate without cilia in the adult
1) Paramecium 2) Vorticella
3) Acineta 4) Stentor

59. Only peristomial cilia are present in the adult stage in
1) Vorticella 2) Paramecium
3) Acineta 4) Ephelota

60. Kinety is
1) Longitudinal row of kinetosomes and interconnecting kinetodesmata in ciliates
2) Longitudinal row of kinetosomes and inter connecting kinetodesmata in flagellates
3) Horizontal row of kinetosomes and interconnecting kinetodesmata in ciliates
4) Horizontal row of kinetosomes and interconnecting kinetodesmata in flagellates

61. Infraciliary system is located in

1) Ectoplasm of ciliates
2) Endoplasm of ciliates
3) Ectoplasm of flagellates
4) Endoplasm of ciliates

LEVEL - II

62. **Statement (S) :** Paramecium is holotrichous
Reason (R) : It has cilia all over the body.
1) Both S and R are true and R is the correct explanation of S
2) Both S and R are false
3) Only S is true but R is not the correct explanation to S
4) Both S and R are true and R is the not correct explanation of S

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**
- Plasmagel & Plasmasol are inter convertable due to **-Physico - Chemical change**
- 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 contains **- 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 **- Solation**
- Conversion of plasma sol into plasma gel 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 end 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 first near the (Solation zone) **- "Uroid"**
- Near the tip of the Pseudopodium is the process of its formation it conversion of **- "Sol into Gel" takes place**
- Gelation occurs at the **- advancing end**
- Solation occurs at the **- Uroid end**
- Gelation and solation 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 forwards 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 endoplam 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**

AMOEBOID LOCOMOTION

LEVEL - I

63. Widely accepted theory for pseudopodial formation is
    1) Contraction theory
    2) Rolling Movement
    3) Sol-gel theory
    4) Surface tension theory
64. Thick contractile non - granular and transparent part of cytoplasm in Amoeba is
    1) Plasma sol 2) Plasma gel
    3) 1 and 2 4) Cytogel
65. Characterstics of plasmagel
    1) Highly viscous 2) Nongranular
    3) Opaque 4) Less in quantity
66. Inter convertibility of sol-gel is
    1) Only a physical change
    2) Only a chemical change
    3) Physico-chemical change
    4) Polymerisation
67. "Fountain zone theory" of amoeboid locomotion is proposed by
    1) Pantin 2) Mast
    3) Hyman 4) Allen

LEVEL - II

68. Hyaline cap in pseudopodial formation occurs
    1) At the advancing end from ectoplasm
    2) At the advancing end from endoplasm
    3) At the retracting end from ectoplasm
    4) At the retracting end from endoplasm
69. At zone of solation
    1) Water is added to endoplasm
    2) Water is removed from endoplasm
    3) Water is removed from ectoplasm
    4) Water is added to ectoplasm
70. Uroid is
    1) Wavy surface of amoeba at the advancing end
    2) Wavy surface near the hyaline cap in Amoeba
    3) Wavy surface near the zone of gelation in Amoeba
    4) Wavy surface near the retracting end
71. The first step in pseudopodial formation
    1) Formation of hyaline cap
    2) Formation of plasmagel tube
    3) Gelation at zone of gelation
    4) Solation at zone of solation
72. Proteins fold during amoeboid locomotion at
    1) Zone of solation due to removal of water
    2) Zone of solation due to addition of water
    3) Zone of gelation due to addition of water
    4) Zone of gelation due to removal of water
73. Back contraction of amoeboid locomotion theory explains that
    1) Actin molecules react with myosin molecules at zone of solation
    2) Actin molecules react with myosin molecules at zone of gelation
    3) Removal of water molecules at zone of gelation
    4) Force is exerted due to hyaline cap formation.
74. According to Gold acre and Lorsch, in the "zone of solation" which change occurs
    1) Folding of protein molecules
    2) Unfolding of protein molecules
    3) Accumulation of protein molecules
    4) Reduction of protein molecules
75. According to Gold acre and Lorsch, in the 'zone of Gelation' which change occurs
    1) Folding of protein molecules
    2) Unfolding of protein molecules
    3) Extenstion of protein molecules
    4) Dissociation of protien molecules
76. Energy for the contraction and relaxation of protein molecules are derived from
    1) ADP 2) ATP
    3) Micro nucleus 4) Nucleus

SWIMMING LOCOMOTION

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

SWIMMING LOCOMOTION

LEVEL - I

77. Undulopodia are
    1) Cilia and flagella of protozoans
    2) Pseudopodia of protozoans
    3) Myonemes of protozoans
    4) Pseudopodia and flagella of protozoans
78. Who called cilia and flagella as undulopodia
    1) Lamarck 2) Hyman
    3) Berthold 4) Mast

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 the 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 an important role - **in their locomotion**

BENDING MOVEMENT OF FLAGELLA OR CILIUM

LEVEL - II

79. ATP ase enzyme is at ..... of cilia and flagella
    1) Singlet microtubules 2) Dynein arms
    3) Triplets of basal granule 4) Radial spokes
80. Cross bridges of myosin filaments are comparable to
    1) Dynein arms of cilia and flagella
    2) Hyaline cap of pseudopodium
    3) Outer sheath of flagella and cilia
    4) Triplets of basal granules
81. Bending of flagellum is brought about by
    1) Sliding of microtubules past each other by the functioning of 'dynein' arms
    2) Sliding of microtubules past each other without the functioning of dynein arms
    3) Movement of microtubules at right angle
    4) Microtubules can not move
82. Identify the correct statement regarding bending of flagellum
    1) Flagellum pushes the fluid medium parallel to the surface of its attachement
    2) Flagellum pushes the fluid medium at right angle to the the surface of its attachement by its bending movement
    3) Flagellum pushes the fluid medium parallel to axis of the axis of the flagellum.
83. **Statement (S) :** In bending movement doublets can not slide past much.
    Reason (R) : Doublets are physically held in place by the radial spokes.
    1) Both S and R are correct and R explains S
    2) Both S and R are correct and R does not explain a
    3) S is correct but R is wrong
    4) S is worng but R is correct

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.**
- Pulling force like a **-Propeller of an Aeroplane**
- Undulation from the tip to the base causes pulling force due to this the organism is **- pulled forward.**
- Pushing force like a **-Propeller of a boat**
- 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 stroke 2) Recovery stroke**

Ciliary locomotion

- Ciliary movement is similar to-**Paddle movement**
- Beating of Cilia of longitudinal row one after another at the same time is called **-Metachronous movement**
- The Cilia of transverse row beat 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**

UNDULATION MOVEMENT

LEVEL - II

84. If any mastigophore is pushed backwards
    1) Undulation is passing from tip to base in a flagellum
    2) Undulation is passing from base to tip in a flagellum
    3) Undulation is spiral
    4) Flagellum is undergoing sidewise lash
85. If undulation passess from tip to base, flagellate
    1) Moves forwards

2) Moves backwards
3) Rotates on its own axis
4) Rotates in opposite direction

86. Undulations are spiral in a flagellum, flagellate
1) Moves forwards
2) Moves backwards
3) Rotates in the same direction
4) Rotates in the opposite direction

87. Pushing force is caused by
1) Undulation from tip to base
2) Undulation from base to tip
3) Undulation is spiral 4) 2 and 3

88. Pulling force is caused
1) Undulation from tip to base
2) Undulation from base to tip
3) Undulation from tip to tip
4) Undulation from base to base

89. Undulation from base to tip causes pushing force which is like
1) The propeller of a boat
2) The propeller of an aeroplane
3) 1 and 2 4) Gyration

90. Undulation from tip to the base causes a pulling force like
1) The propeller of a boat
2) The propeller of an aeroplane
3) 1 and 2 4) Gyration

SIDEWISE LASH MOVEMENT
LEVEL - I

91. Flagellum becomes rigid and stiff during
1) Effective stroke of sidewise lash
2) Recovery stroke of sidewise lash
3) Undular movement from base to tip
4) Undular movement from tip to base

92. Organism moves backwards by
1) Effective stroke 2) Recovery stroke
3) Gyration 4) 1 and 2

93. In which stroke the beating is against the water at right angle to the longitudinal axis of the body and animal moves forward
1) Effective stroke 2) Recovery stroke
3) 1 and 2 4) Gyration

SIMPLE GYRATION MOVEMENT
LEVEL - I

94. A flagellum turns like a screw in
1) simple gyration 2) effective stroke
3) recovery stroke 4) 1 and 3

CILIARY LOCOMOTION
LEVEL - II

95. The sequential movement of cilia in a longitudinal row in Paramecium is
1) Synchronous movement
2) Metachronous movement
3) Gliding movement
4) Undulation in a cilium

96. Synchronous movement related to Paramecium is
1) Simultaneous movement of cilia in a longitudinal row
2) Sequential movement of cilia in a horizontal row
3) Simultaneous movement of cilia in a horizontal row
4) Sequential movement of cilia in a longitudinal row

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.**

GLIDING LOCOMOTION
LEVEL - I

97. Small zigzag movement in the protozoans caused by contracation and relaxation of myonemes is called
1) Gliding movement 2) Gyration
3) Amoeboid movement 4) Metaboly

98. Gliding movement is shown by
1) Amoeba 2) Sporozoans, Cnidosporans
3) All ciliats 4) Sponges

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*** .

METABOLY
LEVEL - I

99. In many protozoans wriggling motion caused by

strips which can slide past one another is called
1) Gliding movement 2) Metaboly
3) Gyration 4) Undulation

REPRODUCTION IN PROTOZOA

- The life process of producing young ones of the same kind is **- Reproduction**
- Reproduction in protozoans takes place by - **asexual and sexual methods**

LEVEL - I

100. Which reproduction plays an important role in evolution
1) Budding 2) Syngamy
3) Sporulation 4) Plasmotomy

101. Longitudinal binary fission seen in
1) Euglena 2) Amoeba proteus
3) Paramecium 4) Ceratium

102. Most important asexual method of reproduction in Protozoa is
1) Plasmotomy 2) Multiple fission
3) Budding 4) Binary fission

103. Uniparental inheritance is seen during
1) Asexual reproduction 2) Syngamy
3) Cytogamy 4) Isogamy

LEVEL - II

104. Match the following

A) Amoeba proteus	i) Transverse fission
B) Euglena	ii) Longitudinal fission
C) Paramecium	iii) Irregular fission
D) Monocystis	iv) Isogamy

	A	B	C	D
1)	iii	ii	i	iv
2)	iii	ii	iv	i
3)	iii	iv	i	ii
4)	iii	iv	ii	i

Asexual reproduction

- Reproduction without the fusion of pronuclei is called **- asexual reproduction**
- Asexual reproduction generally occurs in protozoans during - **the favourable conditions.**
- The favourable conditions are - **optimum temperature, availability of nutrients and other suitable ecological conditions of water.**
- The methods of asexual reproduction are - **binary fission, multiple fission, budding or gemmation, plasmotomy and sporulation**
- In asexual reproduction - **genetic recombination does not occur**
- The young ones show uniparental inheritance, without any genetic variation (clone) in - **asexual reproduction**

BINARY FISSION

- The most common type of reproduction in protozoa is **- Binary fission**
- The division of nuclei is called **-Karyokinesis**
- The division of cytoplasm is called **-Cytokinesis**
- During the binary fission karyokinesis is followed by cytokinesis

TYPES OF BINARY FISSION:

- The binary fission is irregular in**-Amoeba proteus**
- Longitudinal in **-Euglena**
- Transverse in **-Paramecium**
- Longitudinal binary fission is common in - Mastigophores
  a) Euglena is a - **spindle shaped organism**
  b) The body is surrounded by - **proteinaceous pellicle**
- The contractile vacuole in Euglena is present in - **ectoplasm**
- Endoplasm contains - **nucleus, chloroplasts etc.**
- Near the base of the longer flagellum is - **parabasal body (photoreceptor)**
- The organelle present close to the cytopharynx is - **Stigma**
- Binary fission in Euglena takes place during - fovourable conditions and also in the encysted stage.
- During binary fusion of euglena karyokinesis - **Occurs by mitosis**
  The cytokinesis takes place by - **a longitudinal furrow from the anterior end which proceeds towards the posterior end.**
- With the result of the karyokinesis and cytokinesis Euglena divides into - **two daughter individuals**
- Besides the nucleus, the organelles that undergo division are - **blepharoplasts and chloroplasts.**
- The old flagella go to one daughter individual and the other individual develops the new flagella.
- The organelles which disappear (donot divide) during binary fusion and newly developed by the daughter individuals are - **the contractile vacuole, stigma and paraflagellar body**
- The daughter Euglenae formed as a result of Binary fission are like mirror images, hence called **-Symmetrogenic division**

LONGITUDINAL BINARY FISSION

LEVEL - I

105. Symmetrogenic division seen in

1)Euglena 2) Paramecium
3)Amoeba 4) Vorticella

106. In Euglena during longitudinal binary fission which organs do not divide
1) Contractile vacuole, stigma and para flagellar body
2) Blepharoplast, Chromatophores, Stigma
3) Contractile vacuole, Blepharoplast, Nucleus
4) Contractile vacuole, Para flagellar body, Chromatophores

107. In Euglena during longitudinal binary fission which organs undergo division
1) Contractile vacuole, Stigma
2) Blepharoplast, Chromatophore
3) Contractile vacuole, Blepharoplast
4) Para flagellar body, Chromatophores.

108. The daughter Euglenae formed by binary fission are like
1) Mirror images 2) Asymmetrical bodies
3) Unequal bodies 4) Residual bodies

109. Vertical, anterio-posterior division forming two individuals is
1) Cellular division 2) Anterior posterior fission
3) Longitudinal binary fission
4) Longitudinal posterior fission

110. The longitudinal binary fission is seen in
1) Paramecium and Euglena
2) Paramecium and Trypanosoma
3) Trypanosoma and Euglena
4) Amoeba and Plasmodium

111 The organelle that divides in binary fission of Euglena'
1) Cytopharynx 2) Basal granules
3) Contractile vacuole 4) Stigma

112. During longitudinal binary fission which structure is retained by one daughter Euglena and another daughter Euglena develops new one
1) Reservoir 2) Nucleus
3) Chromatophore 4) Flagellum

113. Photoreceptor organelle of Euglena
1) Stigma 2) Paraflagellar body
3) Eye spot 4) Ocelli

LEVEL - II

114. **Statement (S) :** The longitudinal binary fission in Euglena is described as symmetrogenic division
Reason (R) : The daughter individuals formed in the brinary fission of Euglena are mirror images
1) Both S and R are true and R explains S
2) Both S and R are true but R does not explain S
3) S is correct but R is wrong
4) S is wrong but R is correct

Transverse binary fission in Paramecium

- Paremecium is a **- Ciliate protozoan**
- The common name of paramecium is - **Slipper animalcule**
- The body is - **slipper shaped (hence the common name**
- The oral surface is - **flat**
and the aboral surface is - **convex**
- The oral surface contains - **oral groove**
- The oral groove opens - **into the cytopharynx through cytostome.**
- The ectoplasm contains - infraciliary system and trichocysts.
- The endoplasm contains - **two nuclei and two contractile vacuoles, food vacuoles.**
- The two nuclei are
1. **large kidney shaped macronucleus**
and 2. **a small spherical micronucleus.**
- Macronucleus controls - **vegetative function**
- Micronucleus controls - **reproductive function**
- The contractile vacuoles are present - **one at each end.**
- During binary fission paramecium - **stops feeding and the oral groove disappears**
- During Karyokinesis :
Macronucleus divides by - **amitosis**
Micronucleus divides by - **mitosis and form each two daughter nuclei**
- Then two oral grooves begin to appear - **one in the anterior half and another in the posterior half.**
- During cytokinesis - **a constriction appears in the middle of the body**
- By the deepening of the constriction transversely- **two daughter cells are formed.**
- The plane of fission is at right angles to - **Kinetia (perikinetal fission)**
- The anterior daughter individual is called - **Proter**
- The posterior daughter individual is called - **Opisthe**
- Each daughter individual receives - **One contractile vacuole of the parent**
- The second contractile vacuole is formed - **newly by each daughter individual**
- The cytopharnyx of the parent is retained by - **Proter**
- In the Opisthe - **new cytopharynx is formed**
- The process of binary fission in paramecium is completed in about - **2 hours**
- In paramecium the number of binary fissions that may take place in a day is - **four**

- All the paramecia produced asexually by repeated binary fissions from a single parent constitute **- a clone**
- The transverse binary fission in paramecium is called **- homothetogenic binary fission**

TRANSVERSE BINARY FISSION

LEVEL - I

115. Homothetogenic binary fission seen in
1) Euglena 2) Paramecium
3) Amoeba 4) Vorticella

116. Trichocysts are seen in
1) Paramecium 2) Euglena
3) Amoeba 4) Plasmodium

117. Which organs are newly formed in Opisthe
1) Anterior contractile vacuole, Cytopharynx, Oralgroove
2) Posterior contractile vacuole, Cytopharynx
3) Posterior contractile vacuole, Oral groove
4) All the above

118. Number of times a Paramecium can undergo binary fission in a day
1) 5 times 2) 8 times
3) 9 times 4) 4 times

119. A clone in paramecium is
1) Daughter cells formed by conjugation
2) Daughter cells formed by autogamy
3) Daughter cells formed due to repeated binary fission in a single Paramecium
4) Daughter cells formed by endomixis

120. A generation of progeny formed from Paramecium by binary fission
1) Colony 2) First generation
3) Clone 4) Second generation

121. A clone of Paramecium.are
1) That closing together
2) That live as a colony in one place
3) They have same morphology and genetic constitution ‘ ‘
4) They have same number of cilia and nucleus

122. The number of contractile vacuoles in Paramecium
1) 2 2) 1
3) 4 4) 8

123. In Paramecium first step during binary fission is
1) Stops excretion 2) Stops respiration
3) Stops osmoregulation. 4) Stops feeding

124.. At the end of binary fission which daughter form contains the parental anterior contractile vacuole
1) Protist 2) Proter 3) Ophidia 4) Opisthe

LEVEL - II

125. Which is not true about Opisthe
1) New cytopharynx is formed
2) Ophisthe receives posterior contractile vacuole
3) Second contractile vacuole is formed a fresh
4) Receives old cytopharynx

Multiple fission

- The division of the parent into numerous daughter individuals is called - **multiple fission**
- The nucleus divides into many nuclei followed by the cytoplasmic division and many daughter individuals are formed during - **multiple fission**
- Multiple fission is seen in - the **sarcodines and sporozoans**
- Schizogony is - ***asexual multiple fission***.
- The end products of Schizogony grow into **- *trophozoites***.
- The multiple fission by which gametes are formed is - **Gamogony** .
- The multiple fission by which spores or sporozoites are formed is - **Sporogony** .

MULTIPLE FISSION

LEVEL - I

126. Gamogony is a
1) Binary fission 2) Multiple fission
3) Sexual reproduction 4) Syngamy

127. Asexual multiple fission is
1) Schizogony 2) Sporogany
3) Gamogamy 4) Hologamy

Plasmotomy:

- The division of a multinucleate protozoan into multinucleate daughter individuals by cytoplasmic division but without nuclear divisions is called - **Plasmotomy eg : Opalina**

PLASMOTOMY

LEVEL - I

128. A generation of progeny from a Paramecium by binary fission
1) Colony 2) First generation
3) Clone 4) Second generation

129. Asexual reproduction not involving karyokinesis
1) Binary fission 2) Multiple fission
3) Sporogony 4) Plasmotomy

130. **Statement (S)** : During plasmotomy daughter invididulas contain less number of nuclei than the parent

Reason (R) : Plasmotomy does nt involve karyokinesis

1) Both S and R are true and R explains S
2) Both S anbd R are true but R does not explain S
3) S is correct but R is wrong
4) S is wrong but A is correct

Budding

- Budding is common in - **Suctorian protozoans eg : Acinata**
- The bud is - **a smaller individual formed after nuclear division**
- If only one bud is formed at a time such budding is called - ***monotonic budding*** .
- Monotonic budding occurs in - ***Vorticella*** .
- Multiple buds are formed in - ***Suctorians***.
- Exogenous, buds are formed in ***-Ephelota*** .
- Endogenous buds are formed in ***- Acineta***.

BUDDING
LEVEL - I

131. Monotonic budding seen in
1) Paramecium 2) Vorticella
3) Ephelota 4) Acineta

132. Exogenous buds are formed in
1) Amoeba 2) Acineta
3) Ephelota 4) All the above

133. Endogenous buds are formed in
1) Amoeba 2) Acineta
3) Ephelota 4) All the above

Sexual Reproduction

- Reproduction that takes place by the fusion of pronuclei with or without the formation of gametes is **- Sexual reproduction**
- Genetic recombination occurs during - **Sexual reproduction**
- The fusion of similar gametes is called - **Isogamy eg : Monocystis.**
- The fusion of dissimilar gametes is called - **Anisogamy eg : plasmodium**
- Temporary pairing of two individuals for the exchange of the pronuclei and the fusion of pronuclei takes place during - **conjugation**
- The individuals that participate in conjugation are called - **Conjugants.**
- During conjugation, fusion of pronuclei is followed by - **postconjugation fissions.**
- Generally, after the mutual exchange of the pronuclei the conjugants - **separate eg : paramecium**

SEXUAL REPRODUCTION
Level - I

134. Method of sexual reproduction in protozoans are
1) Conjugation, syngamy, automixis, endomixis
2) Conjugation, syngamy, automixis, budding
3) Conjugation, budding, plasmotomy
4) Conjugation, syngamy, automixis, schizogony

135. In Paramecium during fission the micronucleus undergoes
. 1) Amitosis 2) Meiosis
3) Mitosis 4) Endomixis

SYNGAMY

- In protozoans, sexual reproduction takes place by **- syngamy and conjugation.**
- Complete fusion of two gametes is called - **Syngamy**

LEVEL - I

136. The fusion of similar gametes is called
1) Isogamy 2) Anisogamy
3) Polygamy 4) Plasmotomy

137. Isogamy seen in
1)Monocystis 2) Vorticella
3)Plasmodium 4)Amoeba

138. Anisogamy seen in
1)Monocystis 2)Plasmodium
3)Amoeba 4)Paramecium

139. The fusion of pronuclei of two mature organisms which do not form gametes but behave as gametes is called
1) Isogamy 2) Anisogamy
3) Hologamy 4) Cytogamy

Conjugation

- The scientists who defined conjugation as a temporary union between two ciliates belonging to two different mating types for the exchange and reconstitution of nuclear materials (nuclear reorganization) is - **Wichterman. (1953)**

Factors and conditions for conjugation :

- Unfavourable conditions like shortage of food.
- It always occurs only between the individuals belonging to two different "mating types " They exhibit physiological differentiation but appear like morphologically (paramecium) (Morphologically also different in Vorticella)
- Conjugation occurs between two inactive individuals, which have lost their vigour and vitality due to chromosomal imbalance in their macronuclei,

caused by repeated amitotic divisions.
- Conjugation does not take place during favourable conditions.

Condition in Vorticella
- Vorticella is a - **fresh water ciliate protozoan - bell shaped and sessile, attached to the substratum by a long stalk**
- Cilia are present - **around the mouth as peristomial cilia (adoral cilia)**
- Body is covered by - **Pellicle**
- Endoplasm contains - a horse shoe shaped macronucleus and a round micronucleus
- Macronucleus is - **a vegetative nucleus & disappears during conjugation**
- Micronucleus is a reproductive nucleus and involved in - **Conjugation (sexual pronuclei)**
- New macronucleus after conjugation is formed from - **micronucleus**
- Conjugation in Vorticella moniliata takes place between - **a long stalked macro conjugant and a small free swimming microconjugant**

Events in the conjugation
- Formation of micro and macroconjugants.
- Attachment of the conjugants.
- Disappearance of macronucleus.
- Prezygotic nuclear divisions
- Amphimixis
- Postzygotic nuclear divisions
- Post conjugation fissions

CONJUGATION

A) CONJUGATION IN VORTICELLA

LEVEL - I

140. The nucleus which takes part in sexual reproduction in ciliates is
1) Macronucleus 2) Micronucleus
3) Both 1 and 2 4) Trophonucleus

141. In Vorticella, cilia are present around
1) Stalk 2) Body
3) Peristome 4) Vestibule

142. Shape of macronucleus in vorticella is
1) Spherical 2) Triangular
3) Oval 4) Horse shoe shaped

143. Anisogamontogamy seen in
1) Vorticella 2) Paramecium
3) Monocystis 4) Opalina

Formation of micro and macroconjugants.
- Conjugants in Vorticella are formed by - **longitudinal binary fission and unequal division**
- The larger part develops into - **macroconjugant**
- The smaller part develops into - **microconjugant**
- The microconjugant acquires cilia - **at the aboral end.**
- The free swimming conjugant is - **microconjugant**
- The microconjugant differs from the free swimming young individual produced in binary fission, in being smaller in size, and does not develop into an adult with stalk.
- The conjugant which does not feed or encyst and sruvive for about 24 hours only is - **microconjugant**
- The macroconjugant is - **sessile & stationary.**
- The conjugant which physiologically differs from the normal young, individual is - **Macroconjugant**
- Macroconjugant attracts the microconjugant for about - **2 hours**
- Macro & micro conjugants differ - **physiologically & morphologically**

B) FORMATION OF MICRO CONJUGANT AND MACRO CONJUGANT

LEVEL - I

144. Life span of microconjugant of Vorticella
1) Two hours 2) 24 hours
3) 12 hours 4) 12 days

145. In Paramecium during fission the micronucleus undergoes
. 1) Amitosis 2) Meiosis
3) Mitosis 4) Endomixis

146. Large stalked and sedentary gamont of Vorticella is
1) Male gamont 2) Female gamont
3) Macro gamont 4) 2 and 3

147 The life span of macroconj]ugant
1) 2 hrs 2) 10 hrs
3) 24 hrs 4) 48 hrs

148. The faste of macroconjugant if microconjugant is attached to it within 2 hrs
1) It becomes somatic individulas
2) It encysts
3) It will not form a staelk
4) It will not survive

II. Attachment of the conjugants.
- Attachment of microconjugant (of different parentage) with the macroconjugant takes place - at the aboral surface end)
- Microconjugant looses its cilia - **after attachment**

C) ATTACHMENT OF THE CONJUGANTS

LEVEL - I

149. Male gamont of Vorticella attaching with female gamont sheds
1) Pellicle 2) Stalk
3) Ciliary band 4) 1 and 3

150. Soon after attachment the microconjugant looses
1) cilia 2) micronucleus
3) pellicle at the point of contact
4) macronucleus

151. Microconjugant attaches to the macroconjugant through
1) its aboral ciliated end to the aboral ciliated end of macroconjugant
2) its aboral ciliated end to the aboral non-ciliated end of macroconjugant
3) its aboral non-ciliated end to the aboral ciliated end of macroconjugant
4) its oral non-ciliated end to the aboral ciliated end of macroconjugant

III. Disappearance of the macronucleus

- Macronucleus is a - **vegetative nucleus & has no role in conjugation**
- Macronucleus of the conjugants - **disintegrates and disappears**

IV. Prezygotic nuclear divisions.

- The divisions of nucleus without cytokinesis before zygote formation are called - **prezygotic nuclear divisions**
- The micronucleus of the microconjugant undergoes - **three successive divisions.**
- These type of divisions are - **first two divisions are meiosis I & meiosis II and the third one is (cytokinesis does not occur)**
- The total number of nuclei formed after prezygotic nuclear divisions in the microconjugant are - eight (8) haploid of nuclei (half the no of parent chromosomes)
- Of these eight nuclei the number of nuclei that disappear are (7) seven. (only one nucleus remains)
- The number of prezygotic nuclear divisions that occur in the Micronucleus of Macroconjugant - two successive nuclear divisions.
- The type of these nuclear division is - **two divisions of meiosis (Meosis I & II) (without cytokinesis)**
- The total number of nuclei formed after prezygotic nuclear divisions in the macroconjugant are - four haploid nuclei.
- Of these four nuclei - **three disintigrate and disappear (only one nucleus remains)**
- The remaining one nucleus in each conjugant (micro & macro) undergoes one mitotic division and forms a - **migratory (male) pronucleus and a stationary (female) pronucleus.**

D) PREZYGOTIC NUCLEAR DIVISIONS

LEVEL - I

152. Prezygotic nuclear divisions in macroconjugant to form 4 haploid nuclei
1) One reduction division
2) One mitotic division
3) Two reduction divisions
4) Two mitotic divisions

153. Fate of macronucleus during conjugation
1) Divides by endomitosis
2) Divides by mitosis
3) Disintegrates
4) Divides by meiosis

LEVEL - II

154. The total number of nuclei that disapper in both the conjugants during prezygotic nuclear divisions
1) 10 2) 14
3) 9 4) 11

V. Amphimixis

- Between the two conjugnts a passage at the place of contact is formed due to **- dissolving of the pellicle**
- The migratory pronucles (male) of the microconjugant migrates into - **the cytoplasm of macroconjugant**
- The migratory pronucleus, after entering the cytoplasm of the macroconjugant it fuses with - **the female (stationary) pronucleus of macroconjugant**
- The union of the two pronuclei and the cytoplasm is called - **Amphimixis**
- The migratory nucleus of macronucleus enters the - **microconjugant**
- The two pronuclei in the microconjugant - **does not fuse but disintegrate**
- The synkaryon (diploid) in the macroconjugant is called - **zygote nucleus.**

- Haploid chromosomal number of **V**orticella is - **2**

AMPHIMIXIS:

155. 'Synkaryon' formed during vorticella conjugation is located in
1) Microgamont 2) Macrogamont
3) 1 and 2 4) Outside the gamont

VI. Post Zygotic nuclear divisions :

- The number of divisions that take place in the zygotic nucleus are - three series of successive mitotic divisions (post zygotic nuclear divisions)
- The number of nuclei formed by post zygotic nuclear divisions - **(8) eight.**
- Of these eight postzygotic nuclei - **7 become macronuclei and one becomes micronucleus.**
- During the postzygotic nuclear divisions - **cytoplasm does not undergo division**

POSTZYGOTIC NUCLEAR DIVISIONS:

156. The number of nuclei formed at the end of Postzygotic nuclear divisions
1) 4 2) 5
3) 7 4) 8

VII. Post conjugation fissions

- During the post conjugation fissions, the number of divisions are - **three series of binary fissions.**
- During postconjugation fissions - **only the micronucleus divides & the macronuclei are distributed.**
- The number of daughter Vorticella formed at the end of conjugation are - **(7) seven**

POSTCONJUGATION FISSIONS:

Level - I

157. During post conjugant fissions the following alone divides
1) Macronucleus, micronucleus, cytoplasm
2) Micronucleus, cytoplasm
3) Macronucleus, cytoplam
4) Macronucleus, micronucleus

158. How many macro and micro nuclei respectively are present in the daughter cells of Vorticella at the end of first post conjugant fission
1. 4, 1 and 3, 1 2. 4,2 and 3,2
3. 4, 1 and 3,2 4. 4, 0 and 3,1

Significance of Conjugation

- The vigour and vitality lost due to chromosomal imbalance is regained (Rejuvenation) during - Conjugation
- The macronucleus becomes senile (inactive) due to - **repeated binary fissions**
- During conjugation new and active macronucleus is formed from - **micronucleus(material of Synkaryon).**
- Conjugation is a process of - **nuclear reorganisation**
- As meiosis and gametic nuclear fusion of different parentage occur during conjugation, it results in - **gene recombinations and genetic variations**
- Multiplication of Vorticella occurs - **during conjugation.**

II. Other methods of Nuclear Reorganization :

i. Autogamy :

- The process of autogamy was described by - ***W.F. Diller***.
- Autogamy occurs in ***- P. aurelia***.
- The asexual reproduction which resembling conjugation is - ***autogamy*** .

AUTOGAMY :

Level - I

159. Autogamy in Paramecium aurelia was described by
1) W.F. Diller 2) R. Wichterman
3) Woodruff 4) Erdmann

ii. Cytogamy :

- The process of cytogamy was reported by - ***R. Wichterman.***
- Cytogamy occurs in - ***P.caudatum*** .
- The sexual process without neclear exchange is - ***Cytogamy*** .
- It occurs between - ***two individuals*** .
- Only cytoplasm exchanging method is - cytogamy

CYTOGAMY :

160. Cytogamy is seen in
1) Paramecium aurelia 2) Paramecium caudatum

3) Vorticella Monilata 4) Amoeba

161. A sexual process without nuclear exchange is
1) Conjugation 2) Autogamy
3) Cytogamy 4) Endomixis

162. Cytogamy in Paramecium caudatum was reported by
1) W.F. Diller 2) R. Wichterman
3) Woodruff 4) Erdmann

iii. Endomixis :

- The process of endomixis was reported by - ***Woodruff and Erdmann*** .
- Endomixis occurs in ***- P.aurelia*** .
- In endomixis micronucleus divided by - ***mitosis*** .
- Nuclear fusion does not occurs in - ***Endomixis***.
- Senile macronucleus disintegrates and new active macronucleus is formed from - ***micronucleus***.

ENDOMIXIS:

Level - I

163. Endomixis is seen in
1) Paramecium aurelia 2) Paramecium caudatum
3) Vorticella Monilata 4) Amoeba

164. Endomixis in Paramecium aurelia was reported by
1) W.F. Diller 2) Woodruff
3) Erdmann 4) Both 2 and 3

LEVEL - III

165. The following are the statements about Euglena
1) Stichonematic flagella are present in Euglena
II) Euglena exhibits amoeboid locomotion
III) Its axoneme shows 9+2 arrangement
The correct combinatiion is
1) All are ture 2) Only I & II are ture
3) Only I & III are ture 4) Only III & II are ture

166. The following are the statement about flagellum
1) Flagellum usually arises from the anterior end of the body
II) Flagellum contains axial filament
III) It is present in Acinete
The correct combination is
1) All are ture 2) Only I & II are ture
3) Only I & III are ture 4) Only III & II are true

167. The following are the statements about Vorticella
I) During conjugation conjugants never separate
II) Both nuclear fusion and cytoplasmic fusion occur
III) Both conjugants are motile
The correct combination is
1) All are true 2) Only I & II are true
3) Only I & III are true 4) Only III & II are true

168. Identify the type of flagellum in Monas, Urceolus and Polytoma in their sequential order from the following:
A. The flgellum is stichonematic
B. Two or more rows of lateral appendages on the axonemes
C. The flagellum is pantacronematic
D. Lateral appendages are absent and axoneme ends as naked axial filament.
1) A, B, D 2) A, C, D
3) B, A, C 4) B, C, D

169. Study the following:

Types of flagella	**Character**	**Example**
i) Pentacronematic type	having only one row of mastigonemes	Polytoma
ii) Acronematic type	without mastigonemes	Chlamydomonas
iii) Stichonematic tyep	having one(or) two rows of mastigonemes	Astasia
iv) Pantonematic type	having two (or) more rows of mastigonemes	Peranema

Which of the above two are correct
1) i and iv 2) ii and iv 3) ii and iii 4) iii and iv

170. Study the following:

Pseudopodia	**Example**	**Character**
i) Filopodia	Actinophrys	Thread like pseudopodia with pointed tips
ii) Reticulopodia	Elphidium	Branched net work like pseudopodia
iii) Axopodia	Actinophrys	Transparent needle like radiating pseudopodia
iv) Lobopodia	Lecithium	Blunt and finger like pseudopodia

Which of the above two are **incorrect**
1) i and iv 2) ii and iii
3) ii and i 4) ii and iv

171.Study the following:

Animal	Movement	Locomotory Organelles
i) Entamoeba	Amoeboid	Pseudopodia
ii) Paramoecium	Synchronous	Flagella
iii) Monocystis	Metaboly	Myonemes
vi) Euglena	Gliding	Cilia

Which of the following are **incorrect**?

1) iii and ii 2) i and ii
3) i and iii 4) i and iv

172. Match the following :

Flagellum	Example
A)Pantonematic	I) Polytoma
B)Pantachronematic	II) Astasia
C) Stichonematic	III) Trypanosoma
D) Acronematic	IV) Urceolus
V) Monas	

	A	B	C	D
1)	V	IV	II	III
2)	V	III	II	I
3)	V	IV	II	I
4)	V	IV	I	II

174. Match the following :.

List - I	List - II
A) Two or more rows of mastigonemes	I) Anematic
B) Without flimmers	II) Pentacronematic
C) Two or more rows of mastigonemes with axial filament	III) Stichonematic
	IV) Pantonematic
D) Single row of mastigonemes	V) Acronematic

	A	B	C	D
1)	IV	II	III	V
2)	IV	III	II	V
3)	IV	I	II	III
4)	IV	I	III	II

175. Study the following

Type of movement	Locomotoary Structure	Example
i) Swimming	Pseudopodia	Amoeba
ii) Swimming	Cilia	Paramecium
iii) Metaboly	Myonemes	Monocystis
iv) Amoeboid	Flagella	Arcella

Which of the above two are correct

1) i and ii 2) i and iv
3) ii and iii 4) iii and iv

176. Study the following:

Type of flagellum	No.of rows of mastigonemes	Example
i) Stichonematic	4 rows	Astasia
ii) Acronematic	No mastigonemes	Chlamy domonas
iii) Pantacronematic	1 or 2 rows	Polytoma
iv) Pantonematic	2 or more rows	Monas socialis

Which of the above two are **correct**?

1) iv and ii 2) i and iv
3) ii and iii 4) iii and iv

177. Study the following:

Locomotory organell	Character	Animal
i) Stichonematic	One row of mastigonemes	Astasia
ii) Reticulopodia	Filamentous with pointed tips	Polystomella
iii) Pantacronematic	Two or more rows of mastigonems with a terminal filament	Peranema
iv) Axopodia	Needle like with a central axial rod	Actinosphaerium

Which of the above two are **correct**?

1) i and iv 2) ii and iii
3) i and iii 4) ii and iv

178. Arrange the following in ascending order with respect to number of flagella

A) Trichomonas B) Ceratium
C) Giardia D) Trichonympha

1) B - C - D - A 2) A - C - D - B
3) B - A - C -D 4) A - D - C - B

179. **Statement (S) :** Euglena shows stichonematic flagellum

Reason (R) : This flagellum shows only one row of mastigonemes.

1) Both S and R are true and R is the correct explanation of S

2) Both S and R are false

3) Only S is true but R is not the correct explanaiton of S

4) Both S and R are true and R is the not correct explanation of S

180. **Statement (S) : The members of the super class mastigophora bear flagella.**

Reason (R) : Flagellum helps in food collection

1) Both S and R are true and R is the correct explanation of S

2) Both S and R are false

3) Only S is true but R is not the correct explanaiton of S

4) Both S and R are true and R is the not correct explanation of S

181. The following stages are noticed in the conjugation of Vorticella

A) Formation of male and female gamonts

B) Nuclear divisions

C) Attachment of Conjugants

D) Disappearance of macronuclues

Arrange the correct sequence of these stages

1) A - C - B - D 2) A - C - D - B

3) D - C - B - A 4) C- D - A - B

182. Identify the correct statements regarding the nuclei of Vorticella :(EAMCET 2007)

a) Both macro and micro nuclei are diploid

b) Macro nucleus is diploid and micro nucleus is haploid

c) The male and female pro-nuclei are haploid

d) Both pronuclei are diploid

e) Zygote is diploid

1) a, b, c 2) b, c, e

3) a, b, e 4) a, c, e

183. **Statemet (S) :** Conjugation is a temporary union between two ciliates belonging to two different mating types for the exchange and reconstitution of nuclear materials.

Reason (R) : Conjugation occurs between two inactive individuals which have gained their vigour and vitality due to chromosomal imbalance in their macronuclci, caused by repeated amitotic division.

The correct answer is

(1) Both (S) and (R) are true and (R) explains (S).

(2) Both (S) and (R) are true but (R) cannot explain (S).

(3) Only (S) is correct but not (R)

(4) Both (S) and (R) are wrong.

184) **Statement (S) :** An unequal transverse binary fission takes place in Paramecium.

Reason (R) : The cytopharynx of the parent is retained by the proter.

1) S and R are correct. R is the correct explanation to S

2) S and R are correct. R is not the correct explanation to S

3) S is correct and R is wrong

4) S is wrong and R is correct.

185) **Statement (S) :** The logitudinal binary fission in Euglena is a symmetrogenic division.

Reason (R) : The old flagella are retained by one daughter individual and the other develops new flagella.

1) S and R are correct. R is the correct explanation to S

2) S and R are correct. R is not the correct explanation to S

3) S is correct and R is wrong

4) S is wrong and R is correct.

186) Arrange the following stages of amoeba from posterior to anterior end in a sequence.

a) Hyaline cap b) Uroid

c) Geletion zone d) Solation zone

1) b,d,c,a 2) b,d,a,c

3) b,c,d,a 4) b,a,d,c

187) Arrange the following stages of Vorticella during the conjugation in a sequence from the begining to the end.

a) Amphimixis b) Binary fission

c) Formation of pronuclei d) Synkaryon

1) b.c,d,a 2) b,c,a,d

3) b,d,c,a 4) b,a,d,c

188) The following are the statements given on binary fission in Paramecium.

I. A constinction appear in the middle of the body

II. The cytopharynx of the parent is retained by the proter.

III. It is called symmertrogenic division.

1) I and II 2) II and III

3) I and II 4) All are correct.

189) Arrange the following post conjugation stages of Vorticella in a sequence from the begining to the end.
The number of micro nuclei are given as numerator and no. of daughter inviduals as denominator
a) 2 : 1/ 3 and 1:1/ 1 b) 1: 1/ 7
c) 7 : 1/ 1 d) 4 : 1/ 1 and 3:1/ 1

1) c,d,b,a 2) c,d,a,b
3) c,b,d,a 4) c,a,d,b

190) Following are the statements on conjugation in Vorticella
I. Only unfavourable conditions induce conjugation.
II. Conjugation occurs between two mating types of Vorticella.
III. Conjugation occurs between inactive and senile Vorticella.
1) All the three are correct.
2) I and II are correct
3) II and III are correct.
4) I and III are correct.

191). **Statement (S) :** Locomotory organelles are absent in sporoza.
Reason (R) : All sporozoans perform gregarine movement
1) S and R are correct. R is the correct explanation to S
2) S and R are correct. R is not the correct explanation to S
3) S is correct and R is wrong
4) S is wrong and R is correct.

192). Following are the statements on cilia
I. In primitive ciliates the holotrichs arrangement of cilia is present.
II. In advanced ciliates the peritriches arrangement of cilia is present .
III. In suctorians the cilia are absent in the adults.
1) All are correct
2) I and II are correct.
3) II and III are correct
4) I and III are correct.

193). **Statement (S)** A sexual reproduction does not generate new genotypes
Reason (R) In asexual reproduction genetic recombinations does not occur
1) Both S and R are correct and R explains S
2) Both S and R are correct and R does not explain S
3) S is correct but R is wrong
4) S is worng but R is correct

194. The following are the events that occurs during the binary fission of Paramecium
a) oral groove disappear b) stops feeding
c) new oral grooves begin to appear
d) karyokinesis
e) Appearance of constriction in the middle of the body
Arrange the above events in sequence
1) b, a, d, c, e 2) b, a, d, e, c
3) a, b, d, c, e 4) a, b, c, d, e

195. If a diatom undergoes binary fission at the note of one binary fission in a minute it takes one hour to fill a cup. How much time will it state to fill the half cup?
1) 30 minutes 2) 45 minutes
3) 59 minutes 4) 50 minutes

KEY

LOCOMOTION IN PROTOZOA

1) 3 2) 4

LOCOMOTARY STRUCTURES IN PROTOZOA

3) 2 4) 1

PSEUDOPODIA

5) 1 6) 2 7) 3 8) 3 9) 3 10) 3 11) 4
12) 1 13) 1 14) 1 15) 2

FILOPODIA

16) 2 17) 1 18) 4

RETICULOPODIA

19) 2 20) 1 21) 2 22) 3

AXOPODIA

23) 3 24) 4 25) 1 26) 1

FLAGELLA

27)2 28) 1 29) 2 30) 1 31) 2 32) 4 33) 4
34) 4 35) 1 36) 4

ULTRA STRUCTURE OF FLAGELLUM

37) 2 38) 1 39) 3 40) 4 41) 1 42) 1

TYPES OF FLAGELLA

43) 1 44) 4

PANTONEMATIC

45) 2 46) 2

ACRONEMATIC

47) 2 48) 1

PANTACHRONEMATIC

49) 4 50) 4 51) 4 52) 4 53) 4 54) 1

CILIA

55) 2 56) 1 57) 1 58) 3 59) 1 60) 1 61) 1
62) 1

AMOEBOID LOCOMOTION

63) 3 64) 2 65) 4 66) 3 67) 4 68) 1 69) 4
70) 4 71) 1 72) 2 73) 1 74) 1 75) 2 76) 2

SWIMMING LOCOMOTION

77) 1 78) 2

BENDING MOVEMENT OF FLAGELLA OR CILIUM

79) 2 80) 2 81) 1 82) 2 83) 1

UNDULATION MOVEMENTS

84) 1 85) 1 86) 4 87) 2 88) 1 89) 1 90) 1

SIDEWISE LASH MOVEMENT

91) 1 92) 2 93) 1

SIMPLE GYRATION MOVEMENT

94) 1

CILIARY LOCOMOTION

95) 2 96) 3

GLIDING LOCOMOTION

97) 1 98) 2

METABOLY

99) 2

REPRODUCTION IN PROTOZOA

100) 2 101) 1 102) 4 103) 1 104) 1

LONGITUDINAL BINARY FISSION

105)1 106) 1 107) 2 108) 1 109) 3 110) 3 111) 2
112) 4 113) 2 114) 1

TRANSVERSE BINARY FISSION

115) 2 116)1 117) 1 118) 4 119) 3 120) 3 121) 3
122) 1 123) 4 124) 2 125) 4

MULTIPLE FISSION

126) 2 127) 1

PLASMOTOMY

128) 3 129) 4 130) 1

BUDDING

131) 2 132) 3 133) 2

SEXUAL REPRODUCTION

134) 1 135) 3

SYNGAMY

136)1 137) 1 138) 2 13.9) 3

CONJUGATION

A) CONJUGATION IN VORTICELLA

140) 2 141) 3 142) 4 143) 1

B) FORMATION OF MICRO CONJUGANT AND MACRO CONJUGANT

144) 2 145) 3 146) 4 147) 3 148) 1

C) ATTACHMENT OF THE CONJUGANTS

149) 3 150) 1 151) 2

D) PREZYGOTIC NUCLEAR DIVISIONS

152) 3 153) 3 154) 1

AMPHIMIXIS:

155) 2

POSTZYGOTIC NUCLEAR DIVISIONS:

156) 4

POSTCONJUGATION FISSIONS:

157) 2 158) 1

AUTOGAMY :

159) 1

CYTOGAMY :

160) 2 161) 3 162) 2

ENDOMIXIS:

163) 1 164) 4

LEVEL - III

165) 3 166) 2 167) 2 168) 4 169) 2 170) 2 171) 3
172) 3 173) 3 174) 3 175) 1 176) 1 177) 3 178) 1
179) 3 180) 2 181) 4 182) 3 183) 4 184) 4 185)1
186) 2 187) 3 188) 2 189) 1 190) 1 192) 1 193) 1
194) 1 195) 3