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12

BIOLOGY - BOTANY

Study Material

UNIT- VI : REPRODUCTION IN PLANTS

CHAPTER - I : ASEXUAL AND SEXUAL REPRODUCTION IN PLANTS

Dear Teachers! & Students!

We publish this study material on the request of many teachers and students. This study material contains only Book back exercise questions. Way to success – 12th Biology - Botany guide will be published very shortly. Way to success is preparing 12th Biology - Botany guide based on Govt.New Pattern with the help of expert cum experienced teachers to give an assurance for you to score high marks in your public examination.

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UNIT – VI

REPRODUCTION IN PLANTS

Chapter - I

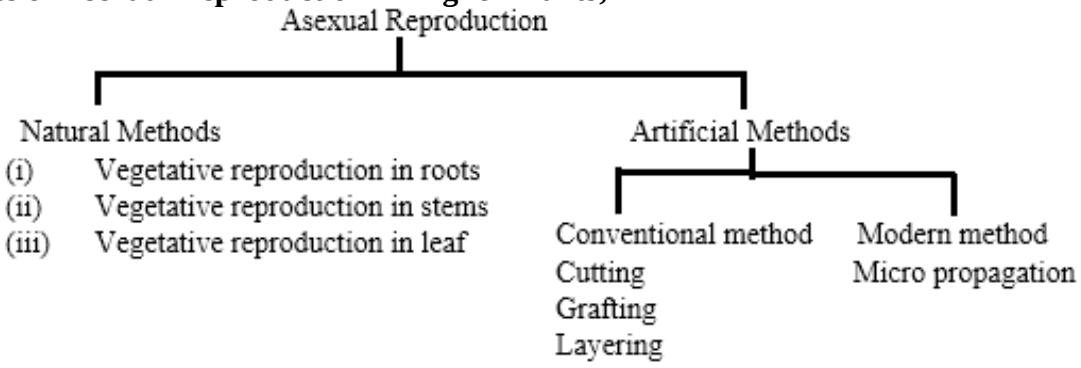
Asexual and Sexual Reproduction in Plants

Important points to remember:

1.Reproduction - One of the essential features of all living things on the earth is Reproduction. Reproduction also plays an important role in Evolution

2. Types of Reproduction- Basically Reproduction occurring in organisms are of two types.
(i) Asexual Reproduction.
(ii) Sexual Reproduction.

3 .Types of Asexual Reproduction in Higher Plants;



4. Sexual reproduction – Sexual Reproduction involves the production and fusion of male and female Gametes. The former is called gametogenesis and latter is the process of Fertilization.

5. Male Reproductive Part - Androecium is known as male reproduction part of a flower. Androecium is made up of stamens

6. Female Reproductive part - Gynocium represents the female reproductive part of the flower. The word gynoecium represents one (or) more pistils of a flower. The word pistil refers to the ovary style and stigma.

7. Types of Ovule - The ovules are classified into six main types based on the orientation, form and position of the micropyle with respect to funicle and chalaza . The types of ovules are.

(i) Orthotropous (iv) Campylotropous
(ii) Anatropous (v)Amphitropous
(iii) Hemianatropous (vi)Circinotropous

8. Pollination - Transfer of pollengrains from the anther to a stigma of a flower is called Pollination.It is a characteristic feature of spermatophytes (Gymnosperms and Angiosperms)

9. Types of pollination - Two types of pollination
(i) Self pollination (or) Autogamy
(ii) Cross pollination (or) Allogamy

10. Self Pollination - The transfer of pollen on the stigma of the same flower is called Self pollination (or) Autogamy

11. Cross pollination - The transfer of pollengrains on the stigma of another flower.It is of two Types.

(i) Geitonogamy
(ii) Xenogamy

12. Contrivances of cross pollination- The flowers of the plants have also several mechanisms that promote cross pollination , which are also called contrivances of cross pollination.

13. **Contrivances of Cross pollination.**

- Dicliny (or) unisexuality
  - (i) Monoecious
  - (ii) Dioecious
- Monocliny(or) Bisexuality
  - (i) Dichogamy
    - (a) Protandry
    - (b) Protogyny
  - (ii) Herkogamy
  - (iii)Hetero styly
    - (a) Distyly
    - (b) Tri styly
    - (c) Self Sterility/ Self incompatibility

14. **Agents of pollination.**

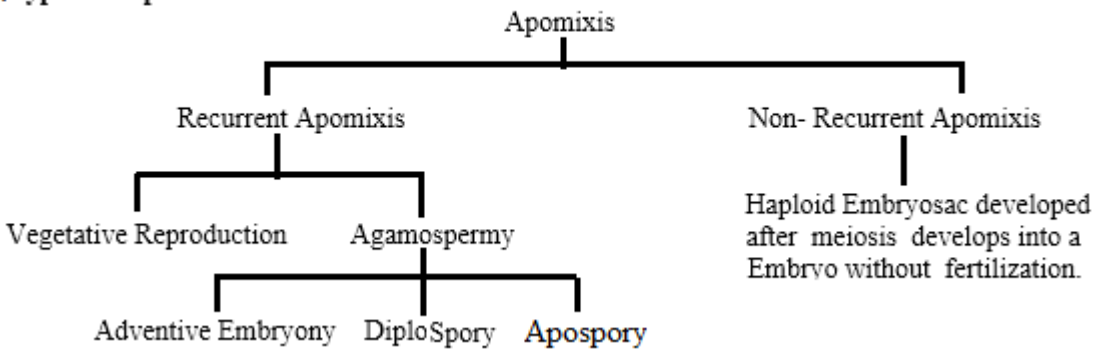
- Pollination
  - Self pollination
  - Cross pollination
    - Abiotic Agents
      - (i) Anemophily (Wind)
      - (ii) Hydrophily (Water)
        - (i) Epihydrophily
        - (ii) Hypohydrophily
    - Biotic Agents
      - (i) Ornithop hily(birds)
      - (ii) Cheiropterophily(bats)
      - (iii)Malacophily(Snails and Slugs)
      - (iv) Entomophily(Insects)
      - (v)Myrmecophily(Ants)
      - (vi)Psychophily (Butterfly)
      - (vii)Mellitophily(Bees)
      - (viii) Phalaenophily(Moths)
      - (ix)Cantharophily (Beetles)
      - (x)Zoophily(Animals)

15. Fertilization - The fusion of male and female gamete is called fertilization. Fertilization in Angiosperm is double fertilization type.

16. Double Fertilization - It is an unique feature of Angiosperm, one of the male gamete fuses with the egg nucleus (Syngamy) to form zygote. The second gamete migrates to the central cell when it fuses with the polar nuclei and forms the primary Endosperm Nucleus (PEN)

17. Amphimixis and Apomixis - Reproduction involving fertilization in flowering plant is called Amphimixis and wherever Reproduction does not involve union of male and female gamete is called Apomixis.

18. Types of Apomixis:



19 .Polyembryony - Occurance of more than one embryo in a seed is called Polyembryony.
(i) Clevage Polyembryony
(ii) Formation of embryo by cells of the embryo.
(iii) Developoment of more than one embryosac within the same ovule.
(iv)Activation of some Sporophytic cells of the ovule.

20. Parthenocarpy - Fruit like structures may develop from the ovary without the act of fertilization. Such fruits are called Parthenocarpic fruits.

TEXTBOOK QUESTIONS

Evaluation – Book Back Questions :

1. Choose the correct statement from the following
a) Gametes are involved in asexual reproduction
b) Bacteria reproduce asexually by budding
c) Conidia formation is a method of sexual reproduction
d) Yeast reproduce by budding

2. An eminent Indian embryologist is
a) S.R.Kashyap ***b) P.Maheswari*** c) M.S. Swaminathan d) K.C.Mehta

3. Identify the correctly matched pair
a) Tuber - *Allium cepa* b) Sucker - *Pistia* ***c) Rhizome - Musa*** d) Stolon - *Zingiber*

4. Pollen tube was discovered by
a) J.G.Kolreuter ***b) G.B.Amici*** c) E.Strasburger d) E.Hanning

5. Size of pollen grain in *Myosotis*
a) 10 micrometer b) 20 micrometer c) 200 micrometer d) 2000 micrometer

6. First cell of male gametophyte in angiosperm is

a) Microspore b) megaspore

c) Nucleus d) Primary Endosperm Nucleus

7. **Match the following**

I) External fertilization - i) pollen grain

II) Androecium - ii)anther wall

III) Male gametophyte - iii)algae

IV) Primary parietal layer - iv)stamens

a) I-iv, II-i, III-ii, IV- iii **b) *I- iii, II-iv, III-I, IV - ii***

c) I-iii, II-iv, III-ii, IV- i d) I-iii, II-I, III-iv, IV- ii

8.Arrange the layers of anther wall from locus to periphery

a) Epidermis,middle layers, tapetum, endothecium

b) Tapetum, middle layers, epidermis, endothecium

c) Endothecium, epidermis, middle layers, tapetum

d) Tapetum, middle layers endothecium epidermis

9. Identify the incorrect pair

a) sporopollenin - exine of pollen grain

b) tapetum – nutritive tissue for developing microspores

c) Nucellus – nutritive tissue for developing embryo

d) obturator – directs the pollen tube into micropyle

10. Assertion : Sporopollenin preserves pollen in fossil deposits

Reason : Sporopollenin is resistant to physical and biological decomposition

a) assertion is true; reason is false

b) assertion is false; reason is true

c) Both Assertion and reason are not true

d) Both Assertion and reason are true.

11. Choose the correct statement(s) about tenuinucellate ovule

a) Sporogenous cell is hypodermal

b) Ovules have fairly large nucellus

c) sporogenous cell is epidermal

d) ovules have single layer of nucellus tissue

12. Which of the following represent megagametophyte

a) Ovule ***b)Embryo sac*** c)Nucellus d)Endosperm

13. In *Haplopappus gracilis*, number of chromosomes in cells of nucellus is 4. What will be the chromosome number in Primary endosperm cell?

a) 8 ***b) 12*** c) 6 d) 2

14. Transmitting tissue is found in

a) Micropylar region of ovule b) Pollen tube wall

c) Stylar region of gynoecium d) Integument

15. The scar left by funiculus in the seed is

a) tegmen b) radicle c) epicotyl ***d) hilum***

16. A Plant called X possesses small flower with reduced perianth and versatile anther. The probable agent for pollination would be

a) water ***b) air*** c) butterflies d) beetles

17. Consider the following statement(s)

i) In Protandrous flowers pistil matures earlier
ii) In Protogynous flowers pistil matures earlier
iii) Herkogamy is noticed in unisexual flowers
iv) Distyly is present in *Primula*

a) i and ii are correct b) ii and iv are correct
c) ii and iii are correct d) i and iv are correct

18. Coelorhiza is found in

a) Paddy b) Bean c) Pea d) Tridax

19. Parthenocarpic fruits lack

a) Endocarp b) Epicarp c) Mesocarp ***d) seed***

20. In majority of plants pollen is liberated at

a) 1 celled stage ***b) 2 celled stage*** c) 3 celled stage d) 4 celled stage

21. What is reproduction?

Reproduction is a vital process for the existence of a species and it also brings suitable changes through variation in the offsprings for their survival on earth.

22. Mention the contribution of Hofmeister towards Embryology.

In 1848, Hofmeister described the structure of pollen tetrad.

23. List out two sub-aerial stem modifications with example.

(i) Runner - Centella Asiatica
(ii) Stolon - Mentha
(iii) Offset - Pistia
(iv) Sucker - Chrysanthemum.

24. What is layering?

- The stem of a parent plant is allowed to develop roots while still intact.
- When the root develops, the rooted part is cut and planted to grow as a new plant.
- Example- Ixora.

25. What are clones?

The individuals formed by asexual reproduction is morphologically and genetically Identical and are called clones.

26. A detached leaf of *Bryophyllum* produces new plants. How?

- In Bryophyllum, the leaf is succulent and notched on its margin.
- Adventitious buds develop at these notches, and are called Epiphyllous buds.
- They develop into new plants forming a root system and become independent plants when the leaf gets decayed.

27. Differentiate Grafting and Layering.

Grafting- Parts of two different plants are joined so they continue to grow as one plant. Of the two plants the plant which is in contact with the soil is called stock and the plant used for grafting is called Scion. **Example:** Citrus, Mango.

Layering- The stem of a parent plant is allowed to develop roots while still intact. When the root develops the rooted part is cut and planted to grow as a new plant. **Example:** Ixora.

28. "Tissue culture is the best method for propagating rare and endangered plant species"- Discuss.

- The genetic ability of a plant cell to produce the entire plant under suitable condition is said to be totipotency.
- This characteristic feature of a cell is utilized in horticulture, forestry and induries for propagating rare and endangered plant species.

29. Distinguish mound layering and air layering.

S. No	Mound Layering	Air Layering
1	This method is applied for the plants having flexible branches. The lower branch with leaves is bent to the ground and part of the stem is buried in the soil and tip of the branch is exposed above the soil	In this method the stem is gridled at nodal region and hormones are applied to this region which promotes rooting. This portion is covered with damp or moist soil using a polythene sheet.
2	After the roots emerge from the part of the stem buried in the soil, a cut is made in parent plant so that the buried part grow into a new plant.	Roots emerge in these branches after 2-4 months. Such branches are removed from the parent plant and grown in a separate pot.

30. Explain the conventional methods adopted in vegetative propagation of higher plants.

The common methods of conventional propagation are Cutting,Grafting and Layering.

(i)Cutting- It is the method of producing a new plant by cutting the plant parts such as root,stem and leaf from the parent plant. The cut part is placed in a suitable medium for growth.Example : Malus,Moringa.

(ii)Grafting- In this parts of two different plants are joined so that they continue to grow as one plant of the two plants, the plant which is in contact with the soil is called Scion. There are different types of Grafting.Example- Citrus,Mango.

(i) Bud Grafting
(ii) Approach Grafting
(iii) Tongue Grafting
(iv) Crown Grafting
(v) Wedge Grafting.

(iii)Layering- In this method, the stem of a parent plant is allowed to develop roots while still intact. When the roots develops, the rooted part is cut and planted to grow as a new plant.

There are 2 types of layering- Mound Layering and Air Layering.

Example: Ixora,Jasminium.

31. Highlight the milestones from the history of plant embryology.

1682	Nehemiah grew mentioned stamens as the male of a flower.
1694	R.J Camerarius described the structure of a flower ,anther,pollen and ovule.
1761	J.G. Kolreuter gave a detailed account on the importance of insects in Pollination.
1824	G.B .Amici discovered the pollen tube.
1848	Hofmeister described the structure of pollen tetrad.
1870	Hanstein described the development of empryo in capsella and alisma.
1878	E.Strasburger reported polyembryony.
1884	E.Strasburger discovered the process of syngamy.
1898,1899	S.G .Nawaschin and L.Guignard independently discovered double Fertilization.
1904	E.Hanning initiated embryo culture.
1950	D.A. Johansen proposed classification for embryo development.
1964	S.Guha and S.C Maheswari raised haploids from Datura pollengrains.
1991	E.S coen and E.M. Meyerowitz proposed the ABC model to describe the Genetics of initiation and development of floral parts.
2015	K.V Krishnamurthy Summarized the molecular aspects of pre and post Fertilization reproductive development in flowering plants.

32. Discuss the importance of Modern methods in reproduction of plants.

(i) Plants with derived characteristics can be multiplied rapidly in a short duration.

(ii) Plants produced are genetically identical.

(iii) Tissue culture can be carried out in any season to produce plants.

(iv) Plants which do not produce viable seeds and seeds that are difficult to germinate can be propagated by tissue culture.

(v) Rare and endangered plants can be propagated.

(vi) Disease free plants can be produced by meristem culture.

(vii) Cells can be genetically modified and transformed using tissue culture.

33. What is Cantharophily?

Pollination by beetle is called Cantharophily.

34. List any two strategy adopted by bisexual flowers to prevent self-pollination.

(i) Dichogamy- In bisexual flowers anthers and stigmas mature at different time.

(a) Protandry- The stamens mature earlier than the stigma of the flower

Example: Helianthus.

(b) Protogyny-The stigmas mature earlier than the stamens of the flower

Example: Aristolochia bracteata.

(ii) Heterostyly- Some plants produce two (or) three different forms of flowers that are different their length of stamen and style. Pollination will take place only between organs of the same length.

35. What is endothelium.?

In some species (unitegmic tenuinucllate) the inner layer of the integument may become specialized to perform the nutritive function for the embrsosac and is called as endothelium (or) integumentary tapetum. **Example:** Asteraceae.

36. "The endosperm of angiosperm is different from gymnosperm". Do you agree. Justify your answer.

I agree. In Angiosperm endosperm produced during triple fusion. In Gymnosperms, Haploid endosperm produced before fertilization.

37. Define the term Diplospory.

A diploid embryosac is formed from megaspore mother cell without a regular meiotic division. **Example:** Eupatorium and Aerva.

38. What is polyembryony? How it can Practically applied?

Occurrence of more than one embryo is called polyembryony.

Practical application

1. The seedlings formed from the nucellar tissue in citrus are found better clones for orchards.
2. Embryos derived through polyembryony are found virus free.

39. Why does the zygote divides only after the division of Primary endosperm cell.

- The primary Endosperm Nucleus divides immediately after fertilization, but before the zygote starts todivide into an endosperm.
- The primary Endosperm Nucleus has 3n number of Chromosomes.
- It is a nutritive tissue and regulatory structure that nourishes the developing embryo.
- So the zygote divides only after the division of primary Endosperm Nucleus.

40. What is Mellitophily?

Pollination by bees is called Mellitophily.

41. "Endothecium is associated with dehiscence of anther" Justify the statement.

The hygroscopic nature of endothecial cell along with thin walled stomium helps in the dehiscence of anther.

42. List out the functions of tapetum.

(i) It supplies nutrition to the developing microspore.
(ii) It contributes sporopollenim through ubisch bodies thus plays an important role in pollen Wall formation.
(iii) The pollenkitt materials is contributed by tapetal cells and is later transferred to the pollen Surface
(iv) Exine proteins respontible for 'rejection reaction' of the stigma are present in the cavities of the exine. These proteins are derived from tapetal cells.

43. Write short note on Pollen kitt.

- Pollenkitt is contributed by the tapetum and coloured yellow (or) orange and is chiefly made of carotenoids(or) flavonoids.
- It is an oily layer forming a thick viscous coating over pollen surface.
- It attracts insects and protects damage from uv radiation.

44. Distinguish tenuinucellate and crassinucellate ovules.

Tenuinucellate Ovule	Crassinucellate Ovule
In the ovule if the sporogenous cell is hypodermal with a single layer of nucellar tissue around it is called tenuinucellate ovule.	Ovules with subhypo - dermal sporogeuous cell is called crassinucellate ovule.
These ovules have very small nucellus.	These ovules have fairly large nucellus.

45. 'Pollination in Gymnosperms is different from Angiosperms' – Give reasons.

Pollination in Gymnosperms is said to be direct, as the pollens are deposited directly on the Exposed ovules, whereas in Angiosperms it is said to be indirect, as the pollens are deposited on the stigma of the pistil.

46. Write short note on Heterostyly.

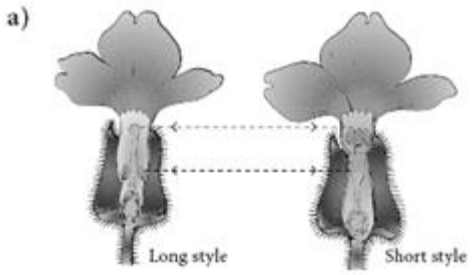
Heterostyly

Some plants produce two (or) three different forms of flowers that are different in their length of stamen and style. Pollination will take place only between organs of the same length.

(a) Distyly

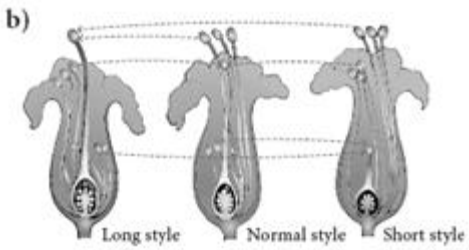
The plant produce two forms of flowers pin (or) long style, long stigmatic papillae, Short stamens and small pollen grains Thrum- eyed (or) short style,small stigmatic papillae, long stamens and large pollen grains**. Example:** primula

The stigma of the thrum-eyed flowers and the anther of the pin lie in same level to bring out pollination. Similarly the anther of thrum-eyed and stigma of pin ones is found in same height.this helps in effective.



(b)Tristyly-

The plant produces three kinds of flowers, with respect to the length of the style and Stamens. Here the pollen from flowers of one type can pollinate only the other two types but not their own type.



Example: Lythrum.

47. Enumerate the characteristic features of Entomophilous flowers

(i) Flowers are generally large or if small they are aggregated in dence inflorescence. Example: Asteraceae flowers

(ii) Flowers are brightly coloured. The adjacent parts of the flowers may also be brightly Coloured to attract insects.Example:In poinsettia and bougainvillea the bracts become Coloured.

(iii) Flowers are scented and produce nectar.

(iv) Flowers in which there is no secretion of nectar, the pollen is either consumed as food or used in building up its hive by the honeybees. Pollen and nectar are the floral Rewards for the visitors.

(v) Flowers pollinated by flies and beefles produce foul odour to attract pollinators.

(vi) In some flowers juicy cells are present which are pierced and the contents are sucked by the insects.

48. Discuss the steps involved in Microsporogenesis.

(i) The primary sporogenous cells directly undergo a few mitotic divisions to form Sporogenous tissue.

(ii) The last generation of sporogenous tissue functions as microspore mother cell.

(iii) Each microspore mother cell divides meiotically to form a tetrad haploid microspores.

(iv) Microspores soon separate from one another and remain free in the anther locule and develop into pollengrains.

49. With a suitable diagram explain the structure of an ovule.

Structure of Ovule (or) Megasporangium

(i) Ovule is protected by one (or) two covering called integuments.

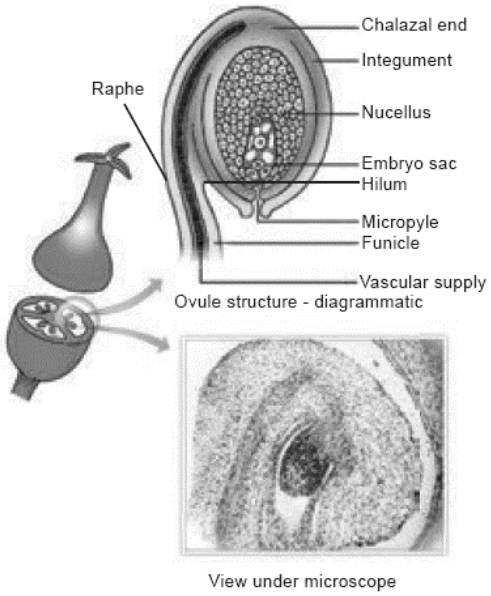
(ii) A mature ovule consists a stalk called funicle is present at the base and it attaches the ovule to the placenta.

(iii) The point of attachment of funicle to the body of the ovule is known as hilum.

(iv) In an inverted ovule, the funicle is adnate to the body of the ovule forming a ridge called raphe.

(v) The body of the ovule is made up of a central mass of parenchymatous tissue called nucellus which has large reserve food materials.

(vi) The nucellus is enveloped by one (or) two protective coverings called Integuments.



(vii) Integuments encloses the nucellus completely except at the top where it is free and forms a pore called micropyle.

(viii) The basal region of the body of the ovule where the nucellus , the integument and the funicle meet or merge is called as chalaza.

(ix) There is a large,oval, sac like structure in the nucellus toward the micropylar end called emryo sac (or) female gametophyte.

(x) It develops from the functional megaspore formed within the nucellus.

50. Give a concise account on steps involved in fertilization of an angiosperm plant.

(i) Germination of pollen to form pollen tube in the stigma.

(ii) Growth of pollen tube in the style

(iii) direction of pollen tube towards the micropyle of the ovule.

(iv) Entry of the pollen tube into one of the synergids of the embryo sac, discharge of male Gametes.

(v) Syngamy and triple fusion.

51. What is endosperm? Explain the types.

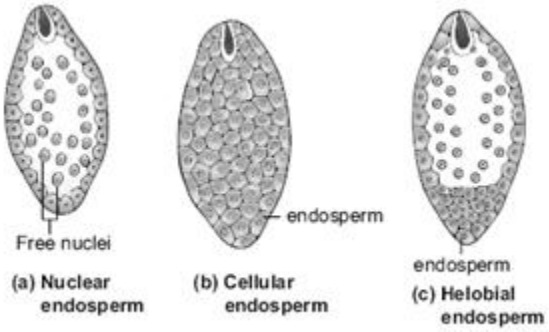
- The primary endosperm nucleus is the result of triple fusion and thus has 3n chromosomes.
- It is a nutritive tissue and regulatory structure that nourishes the developing embryo depending upon the mode of development three types of endosperm are recognized in angiosperms.
- They are nuclear endosperm, cellular endosperm,and helobial endosperm.

(i) Nuclear endosperm - Primary endosperm nucleus under goes several mitotic divisions without Cell wall formation thus a free nuclear condition exists in the endosperm.
Example: Capsella, Arachis and Coccinia.

(ii) Cellular endosperm- Primary endosperm nucleus divides into two nuclei and it is immediately followed by wall formation.Example: Adoxa, Helianthus and scoparia.

(iii) Helobial endosperm-Primary endosperm nucleus moves towards base of embryo sac and divides into two nuclei .cell wall formation taxes place leading to the Formation of a large micropylar and small chalazal chamber.The nucleus of the micropylar chamber undergoes several free nuclear division whereas that of chalazal chamber may(or) may not divide.

Example: Hydrilla and vallisneria.



52. Differentiate the structure of Dicot and Monocot seed.

Dicot Seed	Monocot Seed
1. It consists of two cotyledons	1. It consists of one cotyledon called Scutellum.
2. Coleoptile is absent	2. The Plumule is surrounded by a protective sheath called Coleoptile.
3. Coleorhiza is absent	3. The radicle including root cap is also covered by a protective.
4. Cotyledons stores the food materials.	4. Endosperm stores the food materials.
5. Seed coat is differentiated into outer coat exine and inner coat initine.	5. The seed coat is a brownish, membraneous layer closely adhered to the grain.

53. Give a detailed account on parthenocarpy. Add a note on its significance.

Parthenocarpy – The ovary becomes the fruit and the ovule becomes the seed after Fertilization. In a number of cases, fruit like structures may develop from the ovary without the act of fertilization.Such fruits are called Parthenocarpic fruits and they will not have true seeds. Many commercial fruits are made seed less. **Example :** Banana, Grapes, and Papaya.

(i)Genetic Parthenocarpy - Parthenocarpy arises due to hybridization (or) mutation. Example- Citrus, Cucurbita.

(ii)Environmental Parthenocarpy- Environmental conditions like forest, fog , low temperature High temperature etc. induce parthenocarpy.
Example - Low Temperature for 3-19 hours induces Parthenocarpy in pear.

(iii)Chemically induced Parthenocarpy- Application of growth promoting substances like Auxius and Gibberellins induces Parthenocarpy.

Significance

(i) The seed less fruits have great significance in horticulture.
(ii) The seed less fruits have great commercial importance.
(iii) Seed less fruits are useful for the preparation of jams, sauces, fruit drinks etc.
(iv) High proportion of edible part is available in parthenocarpic fruits due to the absence of seeds.

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BIO - ZOOLOGY

UNIT – I : CHAPTER - 1

REPRODUCTION IN ORGANISMS

Dear Teachers! & Students!

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Best Wishes to All.....

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UNIT –I :Chapter - 1

REPRODUCTION IN ORGANISMS

POINTS TO REMEMBER

Paramecium	Capable of both sexual and asexual reproduction.
Asexual reproduction	Reproduction by a single parent without the involvement of gamete formation.**Eg:**Protista, Bacteria, Archaea.
Somatogenic	Mitotic division of the somatic (body) cell.
Sexual reproduction	The reproductive process involving two types of gametes (ova and sperm). It leads to genetic variation that syngamy (fertilization) and conjugation.
Cytokinesis	Division of the cytoplasm.
Karyokinesis	Division of the nucleus.
Binary fission	The parent organism divides into two halves.
Simple irregular	Simple irregular binary fission - **E.g.**Amoeba.
Transverse	Transverse binary fission - **E.g.** Paramecium and Planaria.
Longitudinal	Longitudinal binary fission - **E.g.**Vorticella and Euglena.
Oblique	Oblique binary fission - **E.g.**dinoflagellates, Ceratium.
Multiple fission	Multiple fission - **E.g.**Vorticella.
Schizogony	In Plasmodium, multiple fission occurs in the schizont.
Sporogony	In Plasmodium multiple fission occurs in the oocyte.
Pelomyxa	Pelomyxa - Giant Amoeba.
Encystment	It occurs in Amoeba.
Plasmotomy	It occurs in Opalina and Pelomyxa.
Strobilation	A special type of transverse fission. **E.g.** Aurelia.
Budding	BuddingE.g. Sponges, Hydra. Exogenous budding **E.g.** Hydra.Endogenous budding **E.g.**Noctiluca.
Gemmules	**E.g.**freshwater sponges, marine sponges.
Regeneration	It was first studied in Hydra by Abraham Trembley in 1740.
Morphallaxis	The whole body grows from a small fragment. E.g. Hydra and Planaria.
Epimorphosis	The replacement of lost body parts. **E.g.** star fish, tail of wall lizard.
External fertilization	The fusion of male and female gametes takes place outside the body of female organisms in the water medium.**E.g.** sponges, fishes and amphibians.
Internal fertilization	The fusion of male and female gametes takes place within the body of female organisms.**E.g.**reptiles, aves and mammals.
Syngamy	The fusion of two haploid gametes.

Autogamy	The male and female gametes are produced by the same cell or same organism and both the gametes fuse together to form a zygote **E.g.**Actinosphaerium and Paramecium.
Exogamy	The different parents and they fuse to form a zygote. **E.g.**Human -dioecious or unisexual animal.
Hologamy	In lower organisms, sometimes the entire mature organisms do not form gametes but they themselves behave as gametes and the fusion of such mature individuals. **E.g.**Trichonympha.
Isogamy	The fusion of identical gametes. **E.g.**Monocystis.
Anisogamy	The fusion of dissimilar gametes.**E.g.** higher invertebrates and all vertebrates.
Parthenogenesis	It is without fertilization that first discovered by Charles Bonnet in 1745.
Natural parthenogenesis	In certain animals, parthenogenesis occurs regularly, constantly and naturally in their life cycle.
Artificial parthenogenesis	The unfertilized egg (ovum) is induced to develop into a complete individual by physical or chemical Stimuli. **E.g.** Annelid and searchin eggs.
Fertilized eggs	Itsinto queen and workers honey bee.
Unfertilized eggs	Its develop into drones (male) honey bee.
Placental cord	The viviparous lemon shark gives birth to a young one, which is still attached by its placental cord.
Arrhenotoky	In this type only males are produced by parthenogenesis. **E.g.** honey bees.
Paedogenetic parthenogenesis	The larvae produce a new generation of larvae by parthenogenesis. **E.g.**sporocysts and Redia larvae of liver fluke, Gall fly.
Ovoviviparity	The embryo develops inside the egg - no placental connection with the mother and nourishment from the egg yolk.E.g.fishes like shark.

TEXTBOOK QUESTIONS

EVALUATION :

1. In which type of parthenogenesis are only males produced?
   a) Arrhenotoky b)Thelytoky c) Amphitoky d) Both a and b
2. Animals giving birth to young ones
   a) Oviparous b) Ovivivіparous **c) Viviparous** d) Both a and b
3. The modes of asexual reproduction in bacteria is by
   a) Formation of gametes b) Endospore formation
   c) Conjugation d) Zoospore formation
4. In which mode of reproduction variations are seen
   a) Asexual b) Parthenogenesis **c) Sexual** d) Both a and b
5. Assertion and reasoning questions:
   I. Assertion (A) : In bee society, all the members are diploid except drones.
   Reason (R) : Drones are produced by parthenogenesis.
   a. A and R are true and R is correct explanation for A.
   b. A and R are true but R is not the correct explanation for A.
   c. A is true but R is false.
   d. Both A and R are false.

II.Assertion (A) : Offsprings produced by asexual reproduction are genetically identical to the parent.
Reason (R) : Asexual reproduction involves only mitosis and no meiosis.
a. A and R are true and R is correct explanation for A
b. A and R are true but R is not the correct explanation for A
c. A is true but R is false
d. Both A and R are false.

III.Assertion (A) : Viviparous animals give better protection to their offsprings.
Reason (R): They lay their eggs in the safe places of the environment.
a. A and R are true and R is correct explanation for A
b. A and R are true but R is not the correct explanation for A
c. A is true but R is false
d. Both A and R are false.

6. Name an organism where cell division is itself a mode of reproduction.
Bacteria, Vorticella and Amoeba.

7. Name the phenomenon where the female gamete directly develops into a new organism with with an avian example.
- ❖ Parthenogenesis (Thelytoky)
- ❖ In this type of parthenogenesis only females are produced by parthenogenesis.
- ❖ **E.g:**Solenobia, Chicken, Pigeon and Turkey.

8. What is parthenogenesis? Give two examples from animals.
Development of an egg into a complete individual without fertilization is known as parthenogenesis. **E.g:**Honey bees, Gall fly.

9. Which type of reproduction is effective -Asexual or sexual and why?
- ❖ Sexual reproduction is effective.
- ❖ Because genetical variation occurs.
- ❖ It leads to evolution.
- ❖ A sexual reproduction involves uniparental inheritance and cannot bring about variation.

10. The unicellular organisms which reproduce by binary fission are considered immortal. Justify.
- ❖ Actually, single celled organisms are considered to be biologically immortal.
- ❖ This is because they don't die as they grow old.
- ❖ Binary fission is seen in unicellular organism like bacteria, Amoeba etc.
- ❖ They usually undergo mitosis to reproduce, in which the organism itself gets divided into two.

11. Why is the offspring formed by asexual reproduction referred as a clone?
- ❖ Asexual reproduction produces offspring that are genetically identical to the parent because the offspring are all clones of the original parent.
- ❖ Offsprings produced by asexual reproduction are morphologically and genetically similar to their parents and so it is called clone.

12. Why are the offsprings of oviparous animal at a greater risk as compared to offsprings of viviparous organisms?
- ❖ Oviparous animals lay eggs outside their body. These eggs are exposed to various environmental conditions and may be eaten by predators also.
- ❖ As a result, the eggs of these animals are under continuous threatfrom various factors.
- ❖ Hence, the offspring of an egg- laying or oviparous animal is at greater risk as compared to the offspring of a viviparous animal, which gives birth to its young ones.

13. Give reasons for the following:

(a) Some organisms like honey bees are called parthenogenetic animals

- ❖ The organisms produced without fertilization of the egg are calledparthenogenetic organisms.
- ❖ The male honey bees are formed from unfertilized eggs.

(b) A male honey bee has 16 chromosomes where as its female has 32 chromosomes. Because

- ❖ Males develop from unfertilized eggs and are haploid (16 chromosomes)
- ❖ Females develop fertilized eggs and are diploid (32 chromosomes)

14. Differentiate between the following:

(a) Binary fission in amoeba and multiple fission in Plasmodium

S.No	Binary fission in amoeba	Multiple fission in Plasmodium
1	The nucleus divides only one.	The nucleus divides repeatedly
2	Two daughter cells are formed	Many daughter cells are formed.
3	Schizont and oocyte stages are not found.	Schizont and oocyte stages are found.

(b) Budding in yeast and budding in Hydra

S.No	Budding in yeast	Budding in Hydra
1	Bud appears as an outgrowth from the parent body.	Buds are formed on the outer surface of the parent body
2	Asymmetrical type	Exogenous budding
3	A Chain of buds may be formed	Chain of buds are not formed.

(c) Regeneration in lizard and Planaria

S.No	Regeneration in lizard	Regeneration in Planaria
1	Epimorphosis type	Morphallaxis type
2	The replacement of lost body parts occurs	The whole body grows from a small fragment.

15. How is juvenile phase different from reproductive phase?

Juvenile phase	Reproductive phase
Juvenile phase/ vegetative phase is the period of growth between the birth of the individual upto reproductive maturity	During reproductive phase/ maturity phase the organisms reproduce and their offsprings reach maturity period.

16. What is the difference between syngamy and fertilization?

Syngamy	Fertilization
It is the process of fusion of two haploid gametes takes place to produce a diploid zygote	The entire process involved in fusion of male and female gamete

ADDITIONAL QUESTIONS

PART - A

Type I. Choose the best answer :

1. Reproduction by a single parent without the involvement of gamete formation
   a) Sexual Reproduction **b) Asexual Reproduction**
   c) Binary Fission d) Multiple Fission
2. When two parents participate in the reproductive process involving two types of gametes
   a) Multiple Fission b) Binary Fission **c) Sexual Reproduction**d) Asexual Reproduction
3. Protista, Bacteria, Archaea are example for

a) Sexual Reproduction b) Regeneration
c) Asexual reproduction d) Simple Binary Fission

4. Division of the parent body into two or more identical daughter individuals
a) Budding b) Fragmentation c) Regeneration **d) Fission**

5. Simple binary fission is seen in
a) Paramecium b) Plasmodium c) Euglena **d) Amoeba**

6. Transverse binary fission is seen in
a) Ceratium b) Euglena
c) Plasmodium **d) Paramecium and Planaria**

7. Longitudinal binary fission is seen in
a) Pasmodium b) Amoeba
c) Hydra **d) Vorticella and Euglena**

8. Oblique binary fission is seen in
a) Hydra b) Euglena **c) Ceratium** d) Amoeba

9. Multiple fission is seen in
a) Plasmodium b) Hydra c) Star Fish d) Euglena

10. When multiple fission occurs in the schizont, the process is called .....and the daughterindividuals are called .....
a) Schizogony and Merozoites b) Sporozoites and Strrobilization
c) Strrobilization and Sporozoites d) MerozoitesandSchizogony

11. When multiple fission occurs in the oocyte, it is called .....and the daughter individualsare called.....
a) Sporozoites and Sporogony b) Merozoitesand Sporozoites
c) Sporogonyand Sporozoites d) Gametozoitesand Sporozoites

12. In some metazoan animals, a special type of transverse fission called
a) Protozoan **b) Strobilation** c) Budding d) Fragmentation

13. Plasmotomy occurs in
a) Hydra b) Euglena c) Paramocium **d) Opalina and Pelomyxa**

14. The gravid proglottidsare regularly cut off either singly or in groups from the posteriorend by a process called
a) Apolysis b) Morphohysis c) Plasmotomy d) Anatomy

15. The division of multinucleated parent into many multinucleate daughter individuals with **the** division of nuclei
a) Apolysis b) Morphohysis **c) Plasmotomy** d) Anatomy

16. During unfavourable conditions Amoeba multiplies by sporulation without encystment.
a) Budding b) Dividing **c) Sporulation** d) Gastrulation

17. The parent body produces one or more buds and each bud grows into a young one is
a) Splitting b) Coiling c) Moulding **d) Budding**

18. When buds are formed on the outer surface of the parent body, it is known as
a) Endogeneous budding b) Mesogeneous budding
c) Daughter body **d) Exogenous budding**

19. In some animals, hundreds of buds are formed inside the cytoplasm and many remainwithin the body of the parent. This is called
a) Endogeneous budding b) Mesogeneous budding
c) Daughter body d) Exogenous budding

20. Noctiluca is example for

a) Exogeneous budding b) Homogeneous budding
c) Mesogeneous budding **d) Endogeneuos budding**

21. Hydra is example for
a) Homogeneous budding b) Endogeneous budding
c) Exogeneous budding d) Gametogeneous budding

22. In freshwater sponges and in some marine sponges a regular and peculiar mode of asexualreproduction occurs by internal buds called
a) Gemmules b) Budding c) Fission d) Conjugation

23. The parent body breaks into fragments (pieces) and each of the fragment has the potential **to** develop into a new individual.
a) Fragmentation b) Destruction c) Formation d) Occassion

24. Regeneration was first studied in Hydra by
a) Charles Bonnet b) Lamark c) Charles Darwin **d) Abraham Trembley**

25. Regeneration was first studied in
a) 1640 b) 1840 c) 1940 **d) 1740**

26. Morphallaxis and Epimorphosis are the types of.....
a) Regeneration b) Reproduction c) Reformation d) Refragmentation

27. The replacement of lost body parts.
a) Exomorphosis b) Endmorphosis **c) Epimorphosis** d) Mesomorphosis

28. Star fish is an example for
a) Restorative generation b) Fertilization
c) Reparative regeneration d) Degeneration

29. Power of regeneration is used in .....
a) Formation of sponges b) Growth of sponges
c) Cultivation of sponges d) Production of sponges

30. The fusion of two haploid gametes takes place to produce a diploid zygote
a) Monogamy **b) Syngamy** c) Exogamy d) Isogamy

31. External fertilization is seen in
a) Hydra b) Amoeba **c) Sponges** d) Star fish

32. The fusion of male and female gametes takes place outside the body of female organisms inthe water medium.
a) Normal fertilization **b) External fertilization**
c) Central fertilization d) Internal fertilization

33. The male and female gametes are produced by different parents and they fuse to form azygote.
a) Merogamy b) Isogamy **c) Exogamy** d) hologamy

34. The fusion of male and female gametes takes place within the body of female organisms.
a) Both Internal and External fertilization b) External fertilization
c) None of these **d) internal fertilization**

35. Reptiles, aves and mammals are the examples of.....
a) External fertilization **b) Internal fertilization**
c) Both A and B d) None of the above

36. The male and female gametes are produced by the same cell or same organism and both thegametes fuse together to form a zygote
a) Autogamy b) Hologamy c) Isogamy d) Merogamy

37. ..... are the examples of Autogamy.

a) Unisexual animal
b) Trichonympha and Paramecium
c) Actinosphaerium and Paramecium
d) Monocystis

38. Trichonympha is an example for.....
a) Merogamy **b) Hologamy** c) Exogamy d) Isogamy

39. The fusion of small sized and morphologically different gametes (merogametes) takes place.
a) Merogamy b) Helogamy c) Isogamy d) Exogamy

40. The fusion of morphological and physiological identical gametes (isogametes) is
a) Exogamy **b) Isogamy** c) Hologamy d) Merogamy

41. The fusion of dissimilar gametes
a) Isogamy b) Hologamy c) exogamy **d) Anisogamy**

42. The examples of Conjugation
a) Reptiles
b) Vorticella and Bacteria
c) Paramecium
d) None of the above

43. Honey bee is an example of
a) Winter Breeders
b) Continuous Breeders
c) Summer Breeders
d) Seasonal Breders

44. frogs, lizards, most birds, deers etc., are the
a) Seasonal Breedors
b) Continuous Breedors
c) Winter Breedors
d) Summer Breedors

45. Development of an egg into a complete individual without fertilization is known as
a) Fertilization
b) Zygoteformation
c) Parthenogenesis
d) Cleavage

46. Parthenogenesis was first discovered by
a) Charles Bonnet b) Charles Darwin c) Lamark d) None of these

47. In certain animals, parthenogenesis occurs regularly, constantly and naturally in their lifecycle and is known as
a) Artificial Parthenogenesis
b) Natural Parthenogenesis
c) Both A and B
d) None of the above

48. In this type only males are produced by parthenogenesis is
a) Thelytoky b) Amphitoky **c) Arrhenotoky** d) None of the above

49. In this type of parthenogenesis only females are produced by parthenogenesis
a) Amphitoky **b) Thelytoky** c) Arrhenotoky d) None of the above

50. In this typeparthenogenetic egg may develop into individuals of any sex.
a) Amphitoky b) Thelytoky c) Arrhenotoky d) None of the above

51. In paedogenetic parthenogenesis is called.....
a) Parthenogenesis b) Heterogenesis c) Merogenesis **d) Paedogenesis**

52. Hen is an example of
a) Viviparous **b) Oviparous** c) Ovoviviparous d) None of the above

53. Cow is an example of
a) Oviparaous **b) Viviparaous** c) Ovivivіparous d) None of the above

54. Shark is an example of
a) Oviparaous b) Viviparaous **c) Ovoviviparous** d) None of the above

Type II. Match the following :

1.

LIST I		LIST II	
p	Sexual reproduction	**i**	Division of the nucleus
q	Asexual reproduction	**ii**	Ova and sperm
r	Karyokinesis	**iii**	Division of the cytoplasm
s	Cytokinesis	**iv**	Single parent

a) p-ii, q-i, r-iii, s-iv
b) p-iii, q-iv, r-ii, s-i
c) p-ii, q-iv, r-i, s-iii
d) p-iv, q-iii, r-ii, s-i

2.

LIST I		LIST II	
p	Simple irregular binary fission	**i**	Ceratium
q	Transverse binary fission	**ii**	Vorticella
r	Longitudinal binary fission	**iii**	Amoeba
s	Oblique binary fission	**iv**	Planaria

a) p-ii, q-i, r-iii, s-iv
b) p-iii, q-iv, r-ii, s-i
c) p-ii, q-iv, r-i, s-iii
d) p-iv, q-iii, r-ii, s-i

3.

LIST I		LIST II	
p	Schizogony	**i**	Aurelia
q	Sporogony	**ii**	Plasmodium
r	Multiple fission	**iii**	Oocyte
s	Strobilation	**iv**	Schizont

a) p-ii, q-i, r-iii, s-iv
b) p-iii, q-iv, r-ii, s-i
c) p- ii, q-iv, r-i, s-iii
d) p-iv, q-iii, r-ii, s-i

4.

LIST I		LIST II	
p	Strobilation	**i**	Leucosolenia
q	Plasmotomy	**ii**	Amoeba
r	Sporulation	**iii**	Opalina
s	Budding	**iv**	Aurelia

a) p-ii, q-i, r-iii, s-iv
b) p-iii, q-iv, r-ii, s-i
c) p-ii, q-iv, r-i, s-iii
d) p-iv, q-iii, r-ii, s-i

5.

LIST I		LIST II	
p	Pelomyxa	**i**	Sponge
q	Exogenous budding	**ii**	Noctiluca
r	Endogenous budding	**iii**	Hydra
s	Gemmule	**iv**	Giant Amoeba

a) p-iv, q-iii, r-ii, s-i
b) p-iii, q-iv, r-ii, s-i
c) p-ii, q-iv, r-i, s-iii
d) p-ii, q-i, r-iii, s-iv

6.

LIST I		LIST II	
p	Fragmentation	**i**	Daughter individuals
q	Plasmotomy	**ii**	Amoeba
r	Multiple fission	**iii**	Pelomyxa
s	Sporozoite	**iv**	Sea anemone

a) p-ii, q-i, r-iii, s-iv
b) p-iii, q-iv, r-ii, s-i
c) p-ii, q-iv, r-i, s-iii
d) p-iv, q-iii, r-ii, s-i

7.

LIST I		LIST II	
p	Morphallaxis	**i**	Star fish
q	Epimorphosis	**ii**	Hydra and Planaria
r	External fertilization	**iii**	Fishes
s	Internal fertilization	**iv**	Reptiles

a) p-ii, q-i, r-iii, s-iv
b) p-iii, q-iv, r-ii, s-i
c) p-ii, q-iv, r-i, s-iii
d) p-iv, q-iii, r-ii, s-i

8.

LIST I		LIST II	
p	Autogamy	**i**	Monocystis
q	Exogamy	**ii**	Trichonympha
r	Hologamy	**iii**	Paramecium
s	Isogamy	**iv**	Human

a) p-ii, q-i, r-iii, s-iv
b) p-iii, q-iv, r-ii, s-i
c) p-ii, q-iv, r-i, s-iii
d) p-iv, q-iii, r-ii, s-i

9.

LIST I		LIST II	
p	Anisogamy	**i**	Honey bees
q	Conjugation	**ii**	Higher invertebrates
r	Continuous breeders	**iii**	Frogs
s	Seasonal breeders	**iv**	Prokaryotes

a) p-ii, q-i, r-iii, s-iv
b) p-iii, q-iv, r-ii, s-i
c) p-ii, q-iv, r-i, s-iii
d) p-iv, q-iii, r-ii, s-i

10.

	LIST I		LIST II
p	Apolysis	**i**	Tail of wall lizard
q	Merogamy	**ii**	Fertilization
r	Syngamy	**iii**	Merogametes
s	Restorative regeneration	**iv**	Taeniasolium

a) p-ii, q-i, r-iii, s-iv
b) p-iii, q-iv, r-ii, s-i
c) p-ii, q-iv, r-i, s-iii
d) p-iv, q-iii, r-ii, s-i

11.

LIST I		LIST II	
p	Arrhenotoky	**i**	Hen
q	Thelytoky	**ii**	Aphis
r	Amphitoky	**iii**	Honey bee
s	Oviparous	**iv**	Solenobia

a) p-ii, q-i, r-iii, s-iv
b) p-iii, q-iv, r-ii, s-i
c) p-ii, q-iv, r-i, s-iii
d) p-iv, q-iii, r-ii, s-i

12.

LIST I		LIST II	
p	Paedogenesis	**i**	Cow
q	Viviparous	**ii**	Gall fly
r	Complete parthenogenesis	**iii**	Female only
s	Incomplete parthenogenesis	**iv**	Both sexual reproduction and parthenogenesis occurs.

a) p-ii, q-i, r-iii, s-iv
b) p-iii, q-iv, r-ii, s-i
c) p-ii, q-iv, r-i, s-iii
d) p-iv, q-iii, r-ii, s-i

13.

LIST I		LIST II	
p	Ovoviviparous	**i**	Chemical stimuli
q	Oviparous	**ii**	Honey bee
r	Incomplete parthenogenesis	**iii**	Egg laying animals
s	Artificial Parthenogenesis	**iv**	Shark

a) p-ii, q-i, r-iii, s-iv
b) p-iii, q-iv, r-ii, s-i
c) p-ii, q-iv, r-i, s-iii
d) p-iv, q-iii, r-ii, s-i

Type III. Assertion and Reasoning :

1. Assertion and Reasoning Question - Choose the correct one.

Assertion (A)	In some metazoan animals, a special type of transverse fission called strobilation occurs
Reason (R)	In the process of strobilation, several transverse fissions occur simultaneously giving rise to a number of individuals which often do not separate immediately from each other

a	**A and R are true and R is correct explanation for A**
b	A and R are true but R is not the correct explanation for A
c	A is true but R is false
d	Both A and R are false.

2. Assertion and Reasoning Question - Choose the correct one.

Assertion (A)	Regeneration is regrowth in the injured region.
Reason (R)	When Hydra is accidentally cut into several pieces, each piece can regenerate the lost parts and develop into a whole new individual

a	A and R are true and R is correct explanation for A
b	**A and R are true but R is not the correct explanation for A**
c	A is true but R is false
d	Both A and R are false.

Type IV. Find the correct/wrong statements or pair :

1. Which of the following is not true regardingConjugation

a) Conjugation is common among parasites.

b)Conjugation is the temporary union of the two individuals of the same species.

c)During their union both individuals, called the conjugants

d) E.g : Paramecium, Vorticella and bacteria (Prokaryotes).

2.Find out the correct statements:

i)Juvenile phase/ vegetative phase is the period of growth between the birth of the individual upto reproductive maturity.

ii) Seasonal breeders reproduce at end of the year.

iii) Continuous breeders continue to breed throughout their sexual maturity

iv) Paedogenesis occurs in the sporocysts and Redia larvae of liver fluke

a) iis correct
b) i and iii,iv are correct
c) ii and iv are correct
d) i,ii iii and iv are correct

3. Which of the following combination is wrongly matched?

a)	Viviparous	Lemon shark
b)	Ovoviviparity	Shark
c)	**Artificial parthenogenesis**	**Biological stimuli**
d)	Oviparous	Amphibians

4.Which of the following combination is wrongly matched?

a)	**Seasonal breeders**	**Rabbit**
b)	Paedogenesis	Redia larvae
c)	Drones	Male honey bee
d)	Charles Bonnet	Parthenogenesis

5.Which of the following combination is rightly matched?

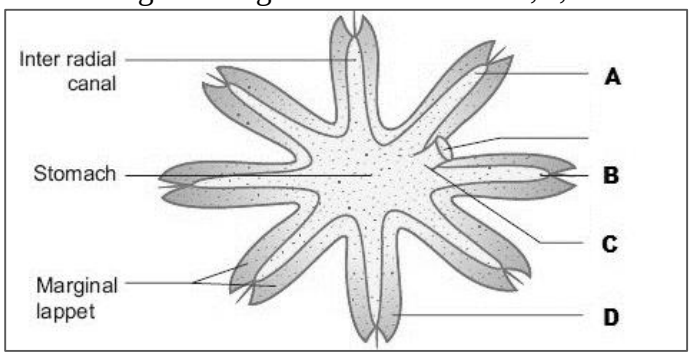
a)	Transverse binary fission	Euglena
b)	Uniparental inheritance	Sexual reproduction
c)	Longitudinal binary fission	Planaria
d)	**Uniparental inheritance**	**Asexual reproduction**

6.Which of the following combination is rightly matched?

a)	Abraham trembley	Planaria
b)	**Plasmotomy**	**Giant Amoeba**
c)	Asexual reproduction	Diploid zygote
d)	Isogamy	Merogametes

Type V. Find the correct parts of diagram :

1. Find the correct parts from the given diagram as mentioned A,B,C and D



a) A- Bifid arm	B -Per radialcanal	C –Sense organ	D -Manubrium
b) A-Manubrium	B -Manubrium	C -Per radialcanal	D -Senseorgan
c) A-Per radialcanal	**B-Sense organ**	**C-Manubrium,**	**D- Bifid arm**
d) A-Sense organ,	B -Manubrium	C - Bifid arm,	D -Per radialcanal

Type VI. Neet based questions :

1. " Nothing lives forever, but life continues". What does it mean? **[AIPMT 1995]**
   a) Older dies but new ones are produced by reproduction
   b) Nothing can produce without death
   c) Death has nothing to do with the continuation oflife
   d) Parthenogenesis is must for sexual reproduction

2. A few statements describing certain features ofreproduction are given below. Select theoptions that are true for both sexual and asexual reproductionfrom the options given:
   i.Gametic fusion takes place
   ii.Transfer of genetic material takes place
   iii.Reduction division takes place
   iv.Progeny have some resemblance with parents

   a)i and ii b)ii and iii **c)ii and iv** d)i and ii

3. A few statements with regard to sexual reproductionare given below:
   i. Sexual reproduction does not always require twoindividuals
   ii. Sexual reproduction generally involves gameticfusion
   iii. Meiosis never occurs during sexual reproduction
   iv. External fertilization is a rule during sexualreproduction
   Choose the correct statements from the options below:
   a)i and iv b)i and ii c)ii and iii **d)i and iv**

4. Given below are a few statements related to external fertilization. Choose the correctstatements:
   i. The male and female gametes are formed andreleased simultaneously
   ii. Only a few gametes are released into the medium
   iii. Water is the medium in a majority of organismsexhibiting external fertilization
   iv. Offspring formed as a result of externalfertilization have better chance of survival thanthose formed inside the organism
   a)iii and iv **b) i and iii** c)ii and iv d)i and iv

5. Which of the following statements, support the viewthat elaborate sexual reproductiveprocess developsmuch later in the organic evolution?
   i) Lower groups of organisms have simpler body design
   ii) Asexual reproduction is common in lower groups
   iii) Asexual reproduction is common in highergroups of organisms
   iv) The high incidence of sexual reproduction is inangiosperms and vertebrates.
   a)i, ii and iii b)i, iii and iv **c)i, ii, and iv** d)ii, iii and iv

PART - B & C

Two and three mark questions :

1.What is Reproduction?

Reproduction is the fundamental feature of all living organisms. It is a biological process by which organisms produce their young ones.

2. What are the basic features of reproduction?

- Synthesis of RNA and proteins,
- Replication of DNA,
- Cell division
- Growth,
- Formation of reproductive units
- Fertilization
- Forming new individuals.

3. What are the two major modes of reproduction.

1. Asexualreproduction 2. Sexual reproduction.

4. What is Asexual reproduction?

Reproduction by a single parent without the involvement of gamete formation is asexual reproduction and the offspring produced are genetically identical.

5. What is sexual reproduction?

When two parents participate in the reproductive process involving two types of gametes (ova and sperm), it is called sexual reproduction. (or) Sexual reproduction involves the fusion of male and female gametes to form a diploid zygote, which develops into a new organism.

6. What are the different modes of asexual reproduction ?

- Fission,
- Budding,
- Fragmentation
- Sporulation,
- Gemmule formation,
- Regeneration.

7. What is fission?

Fission is the division of the parent body into two or more identical daughter individuals.

8. What are the types of fission are seen in animals?

- Binary Fission
- Multiple Fission
- Sporulation
- Strobilation

9. What is binary fission?

- In binary fission, the parent organism divides into two halves and each half forms a daughter individual.
- The nucleus divides first amitotically or mitotically (karyokinesis), followed by the division of the cytoplasm (cytokinesis).
- The resultant offsprings are genetically identical to the parent.

10. What are the types of binary fission are seen in animals ?

- Simple irregular binary fission
- Transverse binary fission
- Longitudinal binary fission
- Oblique binary fission

11. What is Plasmotomy?

Plasmotomy is the division of multinucleated parent into many multinucleate daughter individuals with the division of nuclei.

12.What is apolysis ?

- In the tapeworm, Taeniasolium the gravid (ripe) proglottids are the oldest at the posterior end of the strobila.
- The gravid proglottidsare regularly cut off either singly or in groups from the posterior end by a process called apolysis.

13. What is Regeneration ?

Regeneration is regrowth in the injured region.

14. What are the types of Regeneration?

1. Morphallaxis 2. Epimorphosis.

15. What is Morphallaxis ?

In morphallaxis the whole body grows from a small fragment. **E.g :** Hydra and Planaria.

16. What is Epimorphosis ?

Epimorphosis is the replacement of lost body parts.

17. What are the types of Epimorphosis?

1. Reparative regeneration 2. Restorative regeneration.

18. Differentiate between reparative regeneration and restorative regeneration.

- In reparative regeneration, only certain damaged tissue can be regenerated.
- In restorative regeneration severed body parts can develop. **E.g.**star fish, tail of wall lizard.

19. What is Syngamy ?

In syngamy, the fusion of two haploid gametes takes place to produce a diploid zygote.

20. What is External fertilization ?

In external fertilization, the fusion of male and female gametes takes place outside the body of female organisms in the water medium. E.g : sponges, fishes and amphibians.

21. What is Internal fertilization ?

In internal fertilization, the fusion of male and female gametes takes place within the body of female organisms. **E.g :** reptiles, aves and mammals.

22. What is Autogamy ?

In autogamy, the male and female gametes are produced by the same cell or same organism and both the gametes fuse together to form a zygote .**E.g :**Actinosphaerium and Paramecium.

23. What is Exogamy ?

In exogamy, the male and female gametes are produced by different parents and they fuse to form a zygote. So it is bi-parental. **E.g :** Human – dioecious or unisexual animal.

24. What is Hologamy ?

In lower organisms, sometimes the entire mature organisms do not form gametes but they themselves behave as gametes and the fusion of such mature individuals is known as hologamy. **E.g :**Trichonympha.

25. What is Paedogamy ?

Paedogamy is the sexual union of young individuals produced immediately after the division of the adult parent cell by mitosis.

26. What is Merogamy ?

In merogamy, the fusion of small sized and morphologically different gametes (merogametes) takes place.

27. What is Isogamy ?

The fusion of morphological and physiological identical gametes (isogametes) is called isogamy. **E.g :**Monocystis

28. What is Anisogamy ?

The fusion of dissimilar gametes is calledanisogamy. **E.g :** Higher invertebrates and all vertebrates.

29. What is Conjugation ?

- ❖ Conjugation is the temporary union of the two individuals of the same species.
- ❖ During their union both individuals, called the conjugants exchange certain amount of nuclear material (DNA) and then get separated.
- ❖ Conjugation is common among ciliates.**E.g:** Paramecium, Vorticella and bacteria (Prokaryotes).

30. What are the three Phases of life cycle in Organisms ?

- ❖ Juvenile phase,
- ❖ reproductive phase
- ❖ senescent phase.

31. What is Seasonal breeders?

- ❖ Seasonal breeders reproduce at particular period of the year
- ❖ **E.g :** frogs, lizards, most birds, deers etc.,

32. What is Continuous breeders ?

- ❖ Continuous breeders continue to breed throughout their sexual maturity.
- ❖ **E.g :** honey bees, poultry, rabbit etc.,

33. What is Senescent phase ?

Senescent phase begins at the end of reproductive phase when degeneration sets in the structure and functioning of the body.

34. What is parthenogenesis ?

Development of an egg into a complete individual without fertilization is known as parthenogenesis.

35. What are the two types Parthenogenesis ?

1. Natural Parthenogenesis 2. Artificial Parthenogenesis.

36. What is Arrhenotoky ?

In this type only males are produced by parthenogenesis. **E.g :**Honey bees

37. What is paedogeneticparthenogenesis ?

- In paedogenetic parthenogenesis (paedogenesis) the larvae produce a new generation of larvae by parthenogenesis.
- It occurs in the sporocysts and Redia larvae of liver fluke. It is also seen in the larvae of some insects. **E.g :** Gall fly.

38. What is Thelytoky ?

In this type of parthenogenesis only females are produced by parthenogenesis.**E.g :**Solenobia

39. What is Amphitoky ?

In this typeparthenogenetic egg may develop into individuals of any sex. **E.g :** Aphis.

40. What is Oviparous ?

- In Oviparous animals (egg laying animals), the young hatch from eggs laid outside the mother's body.
- **E.g :**Reptiles and birds, their eggs are covered by hard calcareous shells.
- **E.g :**Invertebrates, fishes and amphibians, eggs are not covered by hard calcareous shells but covered by a membrane.

41. What is Viviparous ?

- Viviparous animals give rise to young ones.
- Viviparity is a type of development in which the young ones are born alive after being nourished in the uterus through the placenta.
- Majority of mammals including human beings are viviparous.

42. What is Ovoviviparous ?

- In Ovoviviparous animals, the embryo develops inside the egg and remains in the mother's body until they are ready to hatch.
- This method of reproduction is similar to viviparity but the embryos have no placental connection with the mother and receive their nourishment from the egg yolk.
- Ovoviviparityis seen in fishes like shark.

PART –D : FIVE MARK QUESTIONS

I. Most expected questions :

1. What is Parthenogenesis ? Explain its types.

Parthenogenesis :

- Development of an egg into a complete individual without fertilization is known as parthenogenesis.
- It was first discovered by **Charles Bonnet** in 1745.
- Parthenogenesis is of two main types namely,

1. Natural Parthenogenesis **2. Artificial Parthenogenesis**

Natural Parthenogenesis

- In certain animals, parthenogenesis occurs regularly, constantly and naturally in their life cycle and is known as natural parthenogenesis.
- Natural parthenogenesis may be of two types, viz.,

1. Complete Natural Parthenogenesis.2. Incomplete Natural Parthenogenesis.

Complete Natural Parthenogenesis:

- It is the only form of reproduction in certain animals and there is no biparental sexual reproduction.

❖ These are no male organisms and so, such individuals are represented by females only.

Incomplete Natural Parthenogenesis :

❖ Itis found in some animals in which both sexual reproduction and parthenogenesis occurs. **e.g.** In honeybees;

❖ Fertilized eggs (zygotes) develop into queen and workers, whereas unfertilized eggs develop into drones (male).

Artificial Parthenogenesis :

In artificial parthenogenesis, the unfertilized egg (ovum) is induced to develop into a complete individual by physical or chemical stimuli. **E.g. Annelid and seaurchin eggs**.

Paedogenesis :

❖ In paedogenetic parthenogenesis (paedogenesis) the larvae produce a new generation of larvae by parthenogenesis.

❖ It occurs in the sporocysts and Redia larvae of liver fluke.

❖ It is also seen in the larvae of some insects**. e.g.Gall fly**.

❖ The white blood corpuscles can be grouped into two categories.

2. What is Regeneration ? Explain its types.

Regeneration

❖ Regeneration is regrowth in the injured region.

❖ Regeneration was first studied in Hydra by Abraham Trembley in 1740.

❖ Regeneration is of **Two** types,

1. Morphallaxis2. Epimorphosis.

Morphallaxis

❖ In morphallaxis the whole body grows from a small fragment e.g. Hydra and Planaria.

❖ When Hydra is accidentally cut into several pieces, each piece can regenerate the lost parts and develop into a whole new individual.

❖ The parts usually retain their original polarity, with oral ends, by developing tentacles and aboral ends, by producing basal discs.

Epimorphosis

❖ Epimorphosis is the replacement of lost body parts.
It is of **Two** types, namely**1) Reparative regeneration2)Restorative regeneration.**

❖ In reparative regeneration, only certain damaged tissue can be regenerated.

❖ In restorative regeneration severed body parts can develop. **E.g.**star fish, tail of wall lizard.

3.Explain the Phases of life cycle.

Organisms have three phases 1. Juvenile phase 2. Reproductive phase 3. Senescent phase.	
1. Juvenile phase	Juvenile phase/ vegetative phase is the period of growth between the birth of the individual upto reproductive maturity.
2. Reproductive phase	During reproductive phase/ maturity phase the organisms reproduce and their offsprings reach maturity period. **On the basis of time, breeding animals are of two types:** 1. Seasonal breeders 2. Continuous breeders.
Seasonal breeders	It reproduce at particular period of the year **e.g**. frogs, lizards, most birds, deers etc.,
Continuous breeders	It continue to breed throughout their sexual maturity **e.g.** honey bees, poultry, rabbit etc.,
3. Senescent phase	Senescent phase begins at the end of reproductive phase when degeneration sets in the structure and functioning of the body.

II. More expected questions :

1. How will you classify the animals based on the site of development of embryo?

Animals are classified mainly into three groups depends on the site of development of embryo and whether they lay eggs (unfertilized or fertilized) or give birth to young ones.

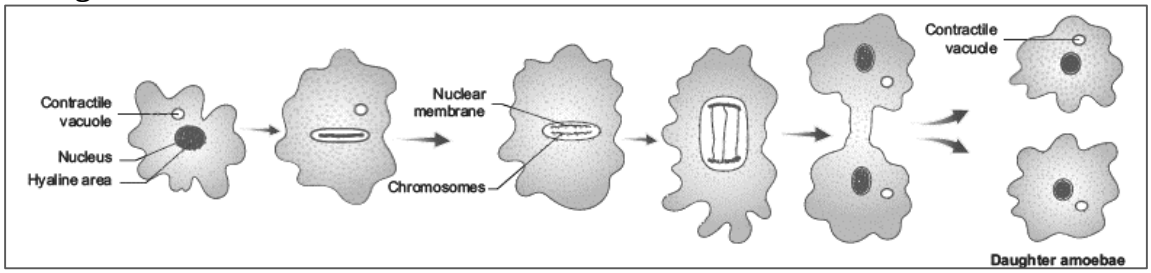
1. Oviparous 2. Viviparous 3.Ovoviviparous

Oviparous	✓ In Oviparous animals (egg laying animals), the young hatch from eggs laid outside the mother's body. ✓ **E.g :**reptiles and birds, their eggs are covered by hard calcareous shells. ✓ **E.g :**Invertebrates, fishes and amphibians (eggs are not covered by hard calcareous shells but covered by a membrane).
Viviparous	✓ Viviparous animals give rise to young ones. ✓ Viviparity is a type of development in which the young ones are born alive after being nourished in the uterus through the placenta. ✓ Majority of mammals including human beings are viviparous.
Ovoviviparous	✓ In Ovoviviparous animals, the embryo develops inside the egg and remains in the mother's body until they are ready to hatch. ✓ This method of reproduction is similar to viviparity but the embryos have no placental connection with the mother and receive their nourishment from the egg yolk. ✓ Ovoviviparityis seen in fishes like shark. ✓ The viviparous lemon shark gives birth to a young one, which is still attached by its placental cord.

III. Averagely Expected questions :

1. Explain the Simple binary fission with diagram

- ❖ Simple binary fission is seen in Amoeba like irregular shaped organisms, where the plane of division is hard to observe.
- ❖ The contractile vacuoles cease to function and disappear.
- ❖ The nucleoli disintegrate and the nucleus divides mitotically.
- ❖ The cell then constricts in the middle, so the cytoplasm divides and forms two daughter cells.
- ❖ **E.g**Amoeba

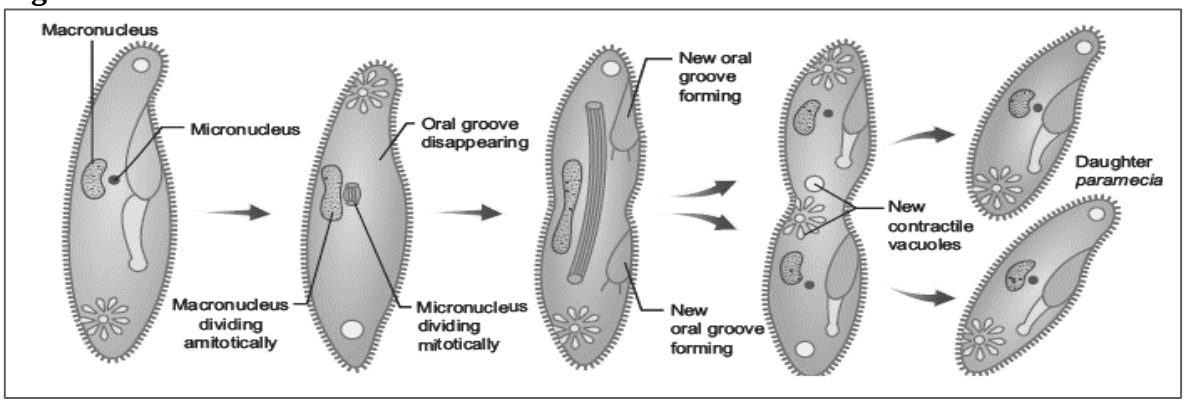


2. Explain the Multiple fission

- ❖ In multiple fission the parent body divides into many similar daughter cells simultaneously.
- ❖ First, the nucleus divides repeatedly without the division of the cytoplasm, later the cytoplasm divides into as many parts as that of nuclei.
- ❖ Each cytoplasmic part encircles one daughter nucleus.
- ❖ This results in the formation of many smaller individuals from a single parent organism.
- ❖ If multiple fission produces four or many daughter individuals by equal cell division and the young ones do not separate until the process is complete, then this division is called repeated fission. **E.g.** Vorticella.

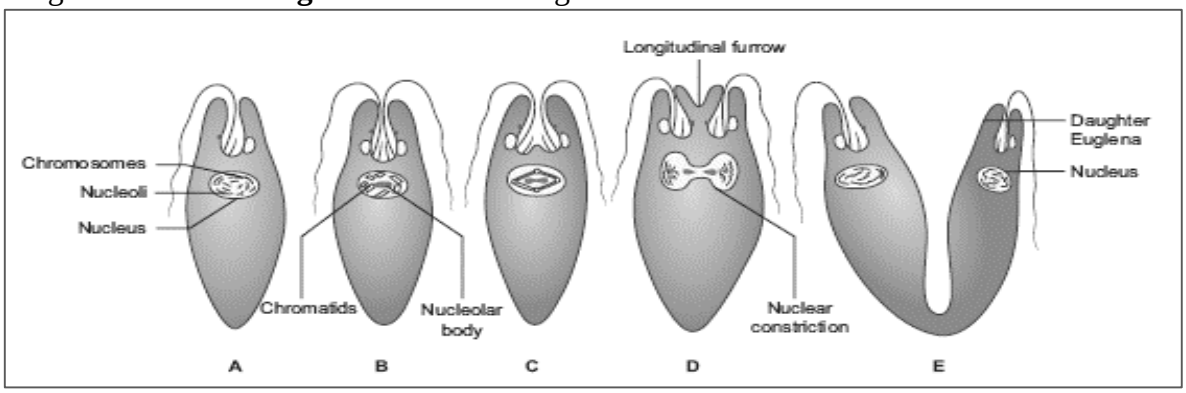
3. Explain the Transverse binary fission with diagram

- ❖ In transverse binary fission, the plane of the division runs along the transverse axis of the individual. **E.g :** Paramecium and Planaria.
- ❖ The macronucleus divides by amitosis and the micronucleus divides by mitosis.
  E.g : Paramecium



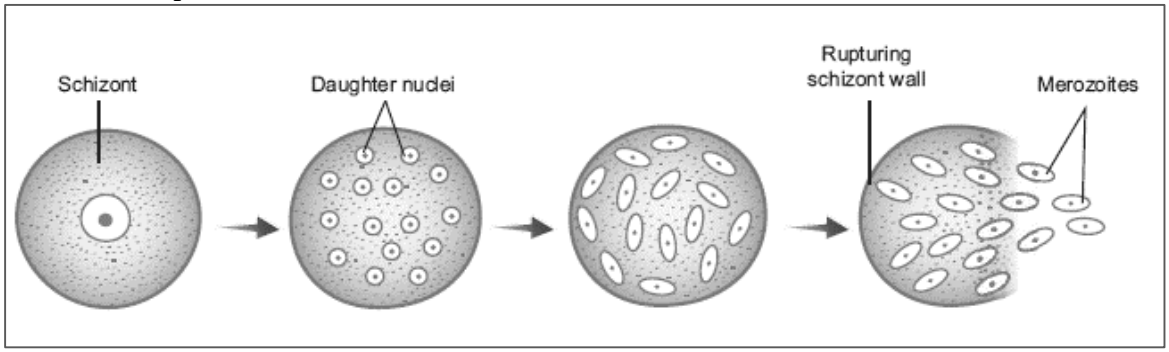
4. Explain the Longitudinal binary fission with diagram

- ❖ In longitudinal binary fission, the nucleus and the cytoplasm divides in the longitudinal axis of the organism.
- ❖ In flagellates, the flagellum is retained usually by one daughter cell.
- ❖ The basal granule is divided into two and the new basal granule forms a flagellum in the other daughter individual. **E.g.** Vorticella and Euglena.



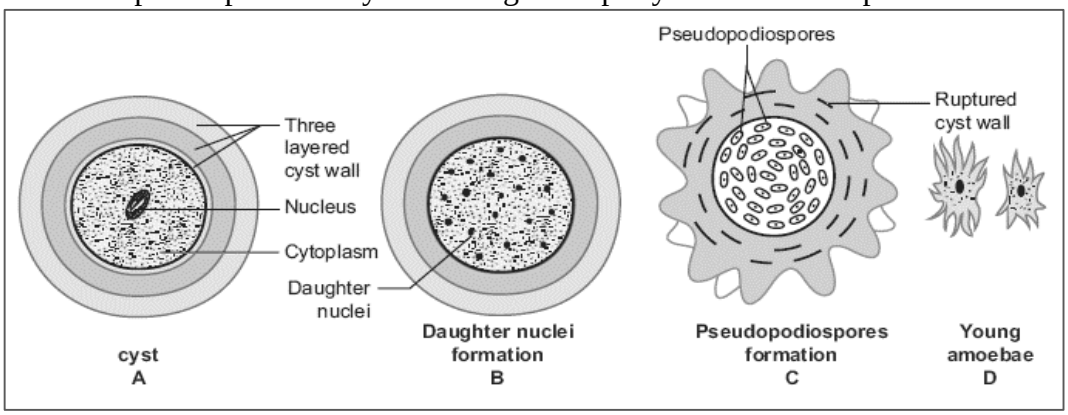
5. Explain the Multiple fission in Plasmodium.

- ❖ In Plasmodium, multiple fission occurs in the schizont and in the oocyte stages.
- ❖ When multiple fission occurs in the schizont, the process is calledschizogony and the daughter individuals are called merozoites.
- ❖ When multiple fission occurs in the oocyte, it is calledsporogony and the daughter individuals are called sporozoites.



6. Explain the Multiple fission in Amoeba.

- During unfavorable conditions (increase or decrease in temperature, scarcity of food) Amoeba withdraws its pseudopodia and secretes a three-layered, protective, chitinous cyst wall around it and becomes inactive.This phenomenon is called encystment.
- When conditions become favourable, the encysted Amoeba divides by multiple fission and produces many minute amoebae called pseudopodiospore or amoebulae.
- The cyst wall absorbs water and breaks off liberating the young pseudopodiospores, each with a fine pseudopodia. They feed and grow rapidly to lead an independent life.

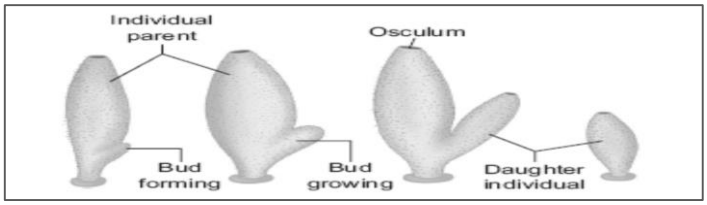


7. What is Budding. Explain the Budding in Leucosolenia (Sponge), Hydra and Noctiluca with diagram.

Budding : In budding, the parent body produces one or more buds and each bud grows into a young one. The buds separate from the parent to lead a normal life.

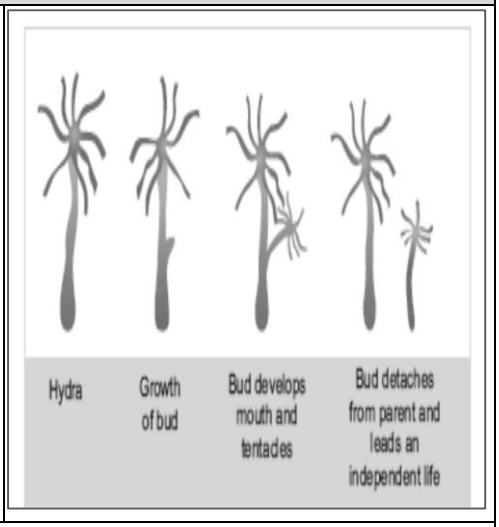
Budding in Leucosolenia (Sponge)

In sponges, the buds constrict and detach from the parent body and the bud develops into a new sponge.



Budding in Hydra

- ✓ When buds are formed on the outer surface of the parent body, it is known as exogenous budding **E.g.** Hydra.
- ✓ In Hydra when food is plenty, the ectoderm cells increase and form a small elevation on the body surface.
- ✓ Ectoderm and endoderm are pushed out to form the bud.
- ✓ The bud contains an interior lumen in continuation with parent's gastrovascular cavity.
- ✓ The bud enlarges, develops a mouth and a circle of tentacles at its free end.
- ✓ When fully grown, the bud constricts at the base and finally separates from the parent body and leads an independent life.



Budding in Noctiluca : In Noctiluca, hundreds of buds are formed inside the cytoplasm and many remain within the body of the parent. This is called endogenous budding.

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