CBSE Class 12 Biology
NCERT Exemplar Solutions
CHAPTER 2
SEXUAL REPRODUCTION IN FLOWERING PLANTS

Multiple Choice Questions

1. Among the terms listed below, those that of are not technically correct names for a floral whorl are:
(i) Androecium
(ii) Carpel
(iii) Corolla
(iv) Sepal

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

Ans. (c) (ii) and (iv)

Explanation: Carpel and sepal are individual parts and make gynoecium and calyx respectively.

2. Embryo sac is to ovule as _____ is to an anther.
(a) Stamen
(b) Filament
(c) Pollen grain
(d) Androecium

Ans. (c) Pollen grain

Explanation: Embryo sac is present in ovule, while pollen grains are present in anther.

3. In a typical complete, bisexual and hypogynous flower the arrangement of floral

whorls on the thalamus from the outermost to the innermost is:
(a) Calyx, corolla, androecium and gynoecium
(b) Calyx, corolla, gynoecium and androecium
(c) Gynoecium, androecium, corolla and calyx
(d) Androecium, gynoecium, corolla and calyx

Ans. (a) Calyx, corolla, androecium and gynoecium

Explanation: Calyx, corolla, androecium and gynoecium

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4. A dicotyledonous plant bears flowers but never produces fruits and seeds. The most probable cause for the above situation is:
(a) Plant is dioecious and bears only pistillate flowers
(b) Plant is dioecious and bears both pistillate and staminate flowers
(c) Plant is monoecious
(d) Plant is dioecious and bears only staminate flowers.

Ans. (d) Plant is dioecious and bears only staminate flowers

Explanation: A pistillate flower can be pollinated from pollen grains from another flower, hence option ‘a’ is incorrect. A dioecious flower can show self or cross pollination and hence can be transformed into fruit. So, option ‘d’ is the correct answer.

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5. The outermost and innermost wall layers of microsporangium in an anther are respectively:
(a) Endothecium and tapetum
(b) Epidermis and endodermis
(c) Epidermis and middle layer
(d) Epidermis and tapetum

Ans. (d) Epidermis and tapetum

Explanation: Epidermis and tapetum

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6. During microsporogenesis, meiosis occurs in:

(a) Endothecium
(b) Microspore mother cells
(c) Microspore tetrads
(d) Pollen grains.

Ans. (b) Microspore mother cells

Explanation: Microspore mother cell undergoes meiosis to produce haploid pollen grains.

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7. From among the sets of terms given below, identify those that are associated with the gynoecium.
(a) Stigma, ovule, embryo sac, placenta
(b) Thalamus, pistil, style, ovule
(c) Ovule, ovary, embryo sac, tapetum
(d) Ovule, stamen, ovary, embryo sac

Ans. (a) Stigma, ovule, embryo sac, placenta

Explanation: Thalamus, tapetum and stamen are not associated with gynoecium.

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8. Starting from the innermost part, the correct sequence of parts in an ovule are,
(a) egg, nucellus, embryo sac, integument
(b) egg, embryo sac, nucellus, integument
(c) embryo sac, nucellus, integument, egg
(d) egg, integument, embryo sac, nucellus.

Ans. (b) egg, embryo sac, nucellus, integument

Explanation: egg, embryo sac, nucellus, integument

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9. From the statements given below choose the option that are true for a typical female gametophyte of a flowering plant:
(i) It is 8-nucleate and 7-celled at maturity
(ii) It is free-nuclear during the development
(iii) It is situated inside the integument but outside the nucellus

(iv) It has an egg apparatus situated at the chalazal end

(a) (i) and (iv)
(b) (ii) and (iii)
(c) (i) & (ii)
(d) (ii) & (iv)

Ans. (c) (i) & (ii)

Explanation: (i) & (ii)

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10. Autogamy can occur in a chasmogamous flower if:
(a) Pollen matures before maturity of ovule
(b) Ovules mature before maturity of pollen
(c) Both pollen and ovules mature simultaneously
(d) Both anther and stigma are of equal lengths.

Ans. (c) Both pollen and ovules mature simultaneously

Explanation: Relative lengths of stigma and anther are not the only factors, time of maturity of pollens and ovules is also important in deciding the type of pollination. If pollens mature before ovules; they will become ineffective by the time the ovule matures. Hence, option 'c' is the correct answer.

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11. Choose the correct statement from the following:
(a) Cleistogamous flowers always exhibit autogamy
(b) Chasmogamous flowers always exhibit geitonogamy
(c) Cleistogamous flowers exhibit both autogamy and geitonogamy
(d) Chasmogamous flowers never exhibit autogamy

Ans. (a) Cleistogamous flowers always exhibit autogamy

Explanation: Cleistogamous flowers do not open at all and thus entry of pollens from another flower is not possible. Hence, cleistomgamous flowers always exhibit autogamy.

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12. A particular species of plant produces light, non-sticky pollen in large numbers and

its stigmas are long and feathery. These modifications facilitate pollination by:
(a) Insects
(b) Water
(c) Wind
(d) Animals.

Ans. (c) Wind

Explanation: Light and non-sticky pollens are ideal to be blown away by wind. Feathery stamens are able to sway with the wind which helps in release of pollens into air.

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13. From among the situations given below, choose the one that prevents both autogamy and geitonogamy.
(a) Monoecious plant bearing unisexual flowers
(b) Dioecious plant bearing only male or female flowers
(c) Monoecious plant with bisexual flowers
(d) Dioecious plant with bisexual flowers

Ans. (a) Monoecious plant bearing unisexual flowers

Explanation: Autogamy can happen in case of bisexual flowers. Geitonogamy can happen in case of dioecious plants bearing only male or female flowers. Hence, option 'a' is correct.

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14. In a fertilised embryo sac, the haploid, diploid and triploid structures are:
(a) Synergid, zygote and primary endosperm nucleus
(b) Synergid, antipodal and polar nuclei
(c) Antipodal, synergid and primary endosperm nucleus
(d) Synergid, polar nuclei and zygote.

Ans. (a) Synergid, zygote and primary endosperm nucleus

Explanation: Synergid, zygote and primary endosperm nucleus

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15. In an embryo sac, the cells that degenerate after fertilisation are:
(a) Synergids and primary endosperm cell

(b) Synergids and antipodals
(c) Antipodals and primary endosperm cell
(d) Egg and antipodals.

Ans. (b) Synergids and antipodals

Explanation: PEN provides food for the growing embryo, while egg develops into embryo. Hence, option 'b' is the correct answer.

16. While planning for an artificial hybridization programme involving dioecious plants, which of the following steps would not be relevant:
(a) Bagging of female flower
(b) Dusting of pollen on stigma
(c) Emasculation
(d) Collection of pollen

Ans. (c) Emasculation

Explanation: In case of dioecious plant, male and female flowers are not usually on a single plant. Hence, emasculation may not be necessary in certain cases.

17. In the embryos of a typical dicot and a grass, true homologous structures are:
(a) Coleorhiza and coleoptile
(b) Coleoptile and scutellum
(c) Cotyledons and scutellum
(d) Hypocotyl and radical.

Ans. (c) Cotyledons and scutellum

Explanation: In monocot, the cotyledon is called scutellum.

18. The phenomenon observed in some plants wherein parts of the sexual apparatus is used for forming embryos without fertilisation is called:
(a) Parthenocarpy
(b) Apomixis

(c) Vegetative propagation
(d) Sexual reproduction.

Ans. (b) Apomixis

Explanation: When seeds are produced without fertilization, this phenomenon is called apomixes. In parthenocarpy, seeds are not produced which means embryos are not produced. Hence, option 'b' is the correct answer.

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19. In a flower, if the megaspore mother cell forms megaspores without undergoing meiosis and if one of the megaspores develops into an embryo sac, its nuclei would be:
(a) Haploid
(b) Diploid
(c) A few haploid and a few diploid
(d) With varying ploidy.

Ans. (b) Diploid

Explanation: Since no meiosis takes place so no change in ploidy will take place.

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20. The phenomenon wherein, the ovary develops into a fruit without fertilisation is called:
(a) Parthenocarpy
(b) Apomixis
(c) Asexual reproduction
(d) Sexual reproduction

Ans. (a) Parthenocarpy

Explanation: Parthenocarpy

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Very Short Answer Type Questions

1. Name the component cells of the 'egg apparatus' in an embryo sac.

Ans. The egg apparatus consists of two synergids and one egg cell.

2. Name the part of gynoecium that determines the compatible nature of pollen grain.

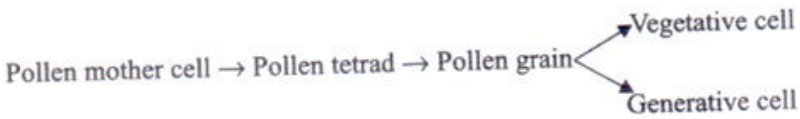
Ans. Pistil has the ability to recognize a compatible pollen grain.

3. Name the common function that cotyledons and nucellus perform.

Ans. Cotyledons and nucellus contain abundant food which is utilized by the developing cells.

4. Complete the following flow chart

Ans.

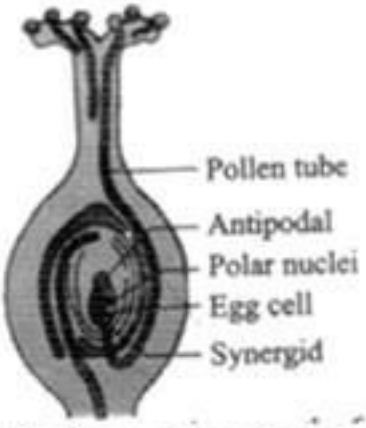


5. Indicate the stages where meiosis and mitosis occur (1, 2 or 3) in the flow chart.

Ans. 1: Meiosis, 2: Mitosis, 3: Mitosis

6. In the diagram given below, show the path of a pollen tube from the pollen on the stigma into the embryo sac. Name the components of egg apparatus.

Ans.



Longitudinal section of a flower showing growth of pollen tube

Synergids and egg cell are the components of egg apparatus.

7. Name the parts of pistil which develop into fruit and seeds.

Ans. The ovary develops into fruits and ovules develop into seeds.

8. In case of polyembryony, if an embryo develops from the synergid and another from the nucellus which is haploid and which is diploid?

Ans. The embryo developing from synergid will be haploid and the embryo developing from nucellus will be diploid.

9. Can an unfertilised, apomictic embryo sac give rise to a diploid embryo? If yes, then how?

Ans. We know that when seeds develop without fertilization, this condition is called apomixis. During apomixis, embryo can develop from nucellus which is diploid. Thus, an apomictic embryo sac can give rise to a diploid embryo.

10. Which are the three cells found in a pollen grain when it is shed at the three celled stage?

Ans. When a pollen grain is shed at the three celled stage, it contains a vegetative cell and two male gametes. The generative cell divides into two male gametes.

11. What is self-incompatibility?

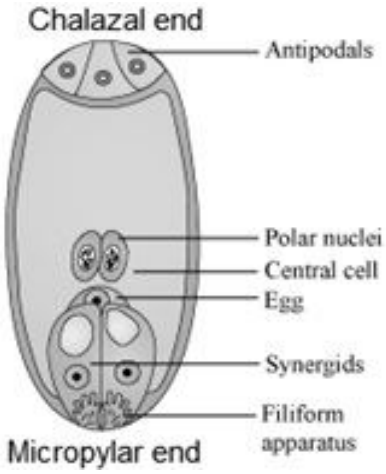
Ans. When pollen from the same plant is incompatible for fertilization, this condition is called self-incompatibility.

12. Name the type of pollination in self-incompatible plants.

Ans. In case of self-incompatible plants, cross-pollination takes place.

13. Draw the diagram of a mature embryo sac and show its 8-nucleate, 7-celled nature. Show the following parts: antipodals, synergids, egg, central cell, polar nuclei.

Ans.



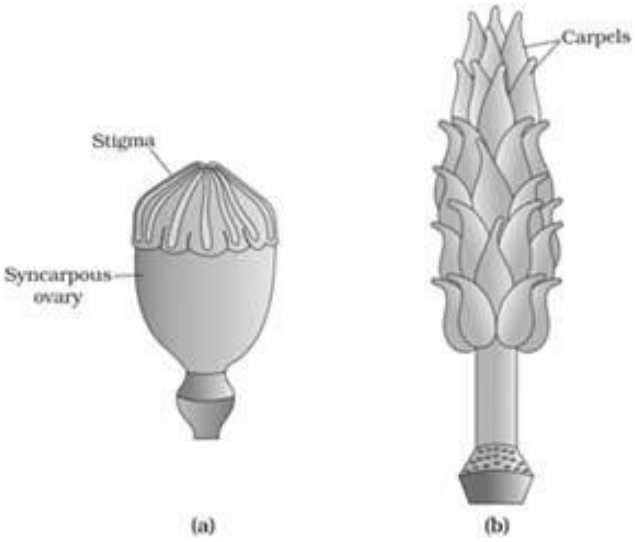
14. Which is the triploid tissue in a fertilised ovule? How is the triploid condition achieved?

Ans. Primary Endosperm Nucleus (PEN) shows triploid condition. When one of the male gametes fuses with the polar nuclei, it results in the formation of triploid PEN.

15. Are pollination and fertilisation necessary in apomixis? Give reasons.

Ans. Apmoixis is a condition in which embryo develops without fertilization. Hence, pollination and fertilization are not necessary for apomixis.

16. Identify the type of carpel with the help of diagrams given below:



Ans. Figure 'a' shows multicarpellary syncarpous condition and figure 'b' shows multicarpellary apocarpous condition.

17. How is pollination carried out in water plants?

Ans. Water mediated pollination happens in selected number of plants. In Vallisneria, the female flower reaches the surface of water. Pollen grains are sprinkled on water surface and they are passively transported to the female flower for pollination. In seagrasses, the female flower remains submerged in water and pollen grains are released below the water surface. In case of pollination by water, pollen grains have mucilaginous covering which prevents the pollens from becoming wet.

18. What is the function of the two male gametes produced by each pollen grain in angiosperms?

Ans. One of the male gametes fuses with the female gamete and forms the embryo. The embryo subsequently develops into a new plant. Another male gamete fuses with polar nuclei and eventually forms endosperm. Endosperm supplies food to the developing embryo.

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Short Answer Type Questions

1. List three strategies that a bisexual chasmogamous flower can evolve to prevent self-pollination (autogamy).

Ans. Following are the three strategies that a bisexual chasmogamous flower can evolve to prevent self-pollination (autogamy):

(a) In many flowers, pollen release and stigma receptivity are not synchronized. Either the pollen is released much before the maturity of stigma or stigma matures much before the release of pollen.

(b) In some flowers, anthers and stigma are placed at different places so that pollen grains from the same flower cannot reach the stigma.

(c) Some flowers follow self-incompatibility between pollen and stigma. This is a genetically mediated process which prevents autogamy in these flowers.

2. Given below are the events that are observed in an artificial hybridization programme. Arrange them in the correct sequential order in which they are followed in the hybridization programme.

(a) Re-bagging

(b) Selection of parents

(c) Bagging

(d) Dusting the pollen on stigma

(e) Emasculation

(f) Collection of pollen from male parent.

Ans. Following is the correct sequence of steps being followed in hybridization:

Selection of parents → Emasculation → Bagging → Collection of pollen from male parent → Re-bagging

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3. Vivipary automatically limits the number of offsprings in a litter. How?

Ans. Viviparity is a condition which is presents in both animals and plants. In case of animals; viviparity means an animal gives birth to young ones. In case of plants, viviparity means germination of embryo on the plant itself; without normal sequence of development of seed. Viviparity involves too much drain of resources on the mother. In case of animals; a female has to constantly supply the nutrients and oxygen to the growing foetus, if the foetus developing in the womb. Enough resources are not available to support a large litter and hence viviparity automatically limits the number of offsprings in a litter. This is true in case of plants also because a germinating embryo on the plant would require resources from the mother plant

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4. Does self-incompatibility impose any restrictions on autogamy? Give reasons and suggest the method of pollination in such plants.

Ans. Self-incompatibility is the condition in which pollen from the same plant cannot pollinate the flower. Thus, self-incompatibility imposes complete restriction on autogamy. This evolution might have occurred in order to prevent too much inbreeding because continuous inbreeding prevent variations. In such plants, cross pollination is the norm and pollen from a plant pollinates the flower on another plant. This ensures accumulation of gene pools from two different plants.

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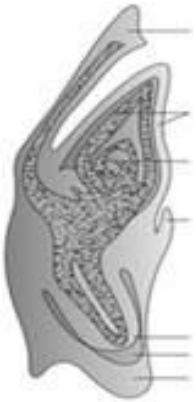
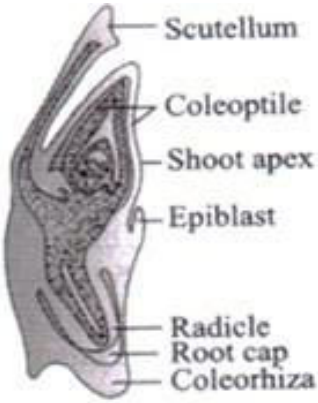
5. In the given diagram, write the names of parts shown with lines.



Ans.



6. What is polyembryony and how can it be commercially exploited?

Ans. In some varieties of citrus and mango, the nucellar cells start dividing and protrude into the embryo sac. They eventually produce multiple embryos. This condition is called polyembryony. This is an apomictic condition in which embryos develop without fertilization. Polyembryony can be commercially exploited by producing seeds of hybrid varieties at lower cost. In case of hybrid plants, a farmer needs to buy seeds every year because plants from hybrid seeds fail to produce hybrid sees due to laws of inheritance. Buying fresh seeds in every season is very costly. If hybrid seeds are produced with polyembryonic condition, then it would be possible for the famers to utilize those seeds for the next year and subsequent years. This is still at research stage but there are bright prospects for future.

7. Are parthenocarpy and apomixis different phenomena? Discuss their benefits.

Hint: Yes, they are different. Parthenocarpy leads to development of seedless fruits. Apomixis leads to embryo development.

Ans. Parthenocarpy is the condition in which fruits develop without seeds, while apomixis is a condition in which seeds develop without fertilization. Fertilization is absent in both the case but seeds are present in apomixis only. Benefits of Parthenocarpy: Seedless fruits are easier to consume; especially those fruits which naturally contain too many seeds, e.g. papaya, watermelon and banana.

Benefits of Apomixis: Apomixis can be used to produce apomicts hybrid seeds so that farmers will not need to buy hybrid seeds every year. This will help in drastically cutting the cost for farmers.

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8. Why does the zygote begin to divide only after the division of Primary endosperm cell (PEC)?

Ans. Endosperm plays the important role of supplying food to the developing embryo. Once the division of Primary Endosperm Cell (PEC) is complete, there is sufficient availability of food for the embryo. In the absence of food, the zygote won't be able to get the necessary raw materials for making new cells. Hence, division of zygote beings only after the division of Primary Endosperm Cell (PEC).

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9. The generative cell of a two-celled pollen divides in the pollen tube but not in a three-celled pollen. Give reasons.

Ans. In a three-celled pollen, one of the cells is a vegetative cell which has no role to play in fertilization. The remaining two cells are the male gametes and they are the actual participants in fertilization. Hence, inside the pollen tube, the generative cells divide rather than the vegetative cell. In 60% of the cases, the generative cell divides inside the pollen tube. In remaining case, the generative cell divides much before pollination.

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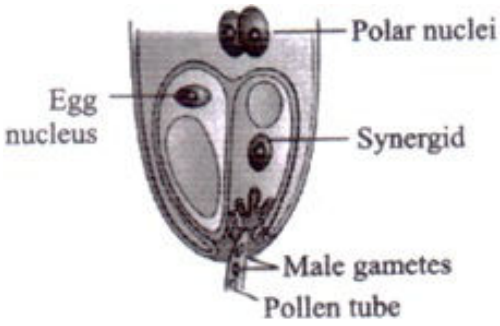
10. In the figure given below label the following parts: male gametes, egg cell, polar nuclei, synergid and pollen tube

Ans.


Polar nuclei
Egg nucleus
Synergid
Male gametes
Pollen tube

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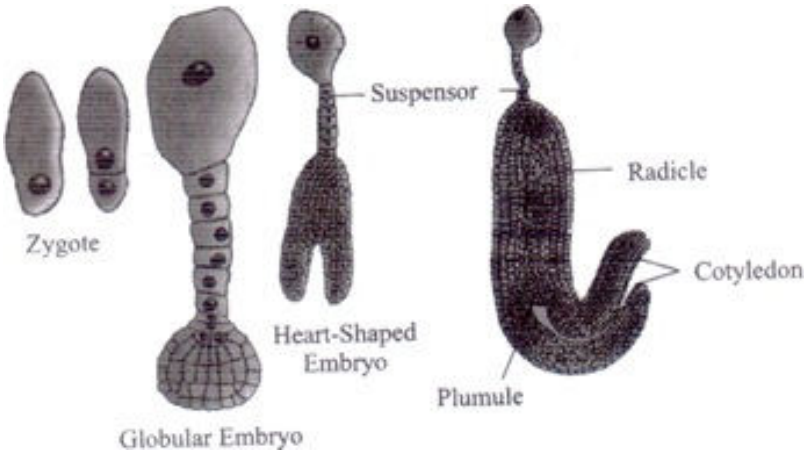
Long Answer Type Questions

1. Starting with the zygote, draw the diagrams of the different stages of embryo development in a dicot.

Ans.



2. What are the possible types of pollinations in chasmogamous flowers. Give reasons.

Ans. Chasmogamous flowers: These are open flowers in which stigma and anthers are exposed and flowers are similar to other species. Possible types of pollinations in chasmogamous flowers are as follows:

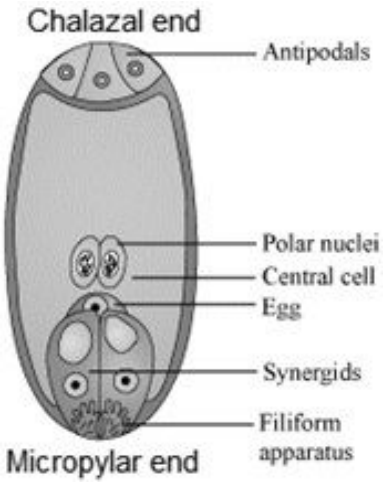
(a) **Geitonogamy:** The situation in which pollen grains from the same plant but different flower reaches the stigma is called geitonogamy. This is similar to autogamy because the zygote gets the gene pool from the same plant.

(b) **Xenogamy:** The situation in which pollen grains from a different plant reaches the stigma is called xenogamy. This can be termed as the true cross-pollination because the zygote gets the gene pool from two different plants.

Most of the plants produce hermaphrodite flowers and thus self-pollination is a clear cut eventuality. But continuous self-pollination can result in inbreeding depression. Variation will not be possible in case of self-pollination. Hence, plants have evolved various ways and means to facilitate cross pollination even in dioecious flowers. One of the strategies followed by plants is loss of synchronization between pollen release and stigma maturity. Another strategy is self-incompatibility between pollens and stigma of the same flower. A third strategy is the positional difference between anthers and stigma so that pollens from the same flower are unable to reach the stigma.

3. With a neat, labelled diagram, describe the parts of a mature angiosperm embryo sac. Mention the role of synergids.

Ans.



Structure of a Mature Embryo Sac: A mature embryo sac is a 7-celled structure and has 8 nuclei. The end near the micropyle is called the micropylar end while the opposite end is called the chalazal end. Following are the main parts of the embryo sac:

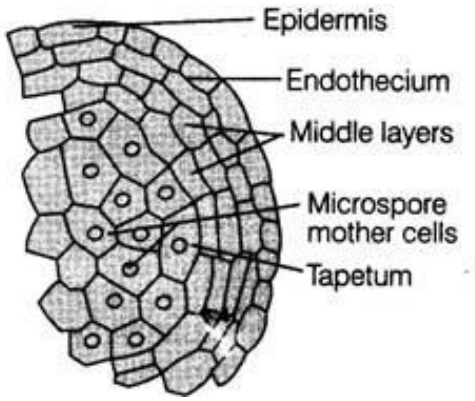
Egg Apparatus: The egg apparatus is composed of two synergids and an egg. There are special thickenings at the micropylar end of synergids. These thickenings are called filiform apparatus.

Function of Synergids: The synergids provide a channel to the pollen tube to enter through filiform apparatus.

Polar Nuclei: The two nuclei enclosed in the central cell are called polar nuclei.

Antipodals: The three cells at the chalazal end are called antipodals.

4. Draw the diagram of a microsporangium and label its wall layers. Write briefly on the role of the endothecium.



Ans. Role of Endothecium: Endothecium; along with the epidermis and the middle layer; provides protection to the pollens during development. Once pollen grains are mature, the three layers (including endothecium) rupture and thus facilitate dehiscence of pollens.

5. Embryo sacs of some apomictic species appear normal but contain diploid cells. Suggest a suitable explanation for the condition.

Ans. Condition in which seeds are produced without fertilization is called apomixis. Apomixis is a kind of asexual reproduction but it mimics sexual reproduction. There are several mechanisms for apomixis. Once of them is seen in citrus and mango fruits. In this case, the nucellus beings to divide and intrude into the embryo sac. It eventually develops into seed. Since nucellus is composed of diploid cells, embryo sac in such case has diploid cells.

It is also important to recall that fertilization cannot happen in those cells which were not formed after meiosis. Moreover, haploid cells are never involved in apomixes rather it is the diploid cells which bring apomixes. Hence, embryo sacs apomictic species appear normal but contain diploid cells.