

1. SEXUAL REPRODUCTION IN FLOWERING PLANTS

Single Page Simple Synopsis

Sexual reproduction in flowering plants (angiosperms) involves the fusion of male and female gametes to produce seeds. This process is driven by the flower's reproductive organs: the male stamen produces pollen, and the female egg inside the ovule.

Four Core Concepts:

1. **The Reproductive Organs:** Flowers act as the reproductive hubs of angiosperms.

Androecium (Male part): Consists of stamens.

Each stamen is made of an anther (where pollen grains develop) and a filament.

Gynoecium (Female part): Consists of pistils or carpels. Each pistil has three parts:

i) **Stigma:** A sticky landing surface for pollen.

ii) **Style:** A tube connecting the stigma to the ovary.

iii) **Ovary:** The swollen base containing the ovules (eggs).

2. **Pollination** is the transfer of pollen from the anther to the stigma.

It can happen via wind, water, or animal pollinators.

Self-pollination: Pollen moves to the stigma of the *same* flower or another flower on the *same* plant.

Cross-pollination: Pollen moves to the stigma of a flower on a different plant of the same species.

3. **Fertilization & Double Fertilization:**

Once the pollen lands on the stigma, a unique process exclusive to flowering plants occurs:

i) **Pollen Germination:** The pollen grain grows a pollen tube down through the style to reach the ovary.

ii) **Sperm Delivery:** The pollen tube releases two male gametes into the ovule.

iii) **Double Fertilization:**

a) **Zygote Formation:** One male gamete fuses with the egg cell to form a diploid zygote.

b) **Endosperm Formation:** The second male gamete fuses with two polar nuclei to form a triploid endosperm. The endosperm provides nutritional support for the developing embryo.

4. **Seed and Fruit Development:**

Following fertilization, the flower undergoes significant physical changes:

The fertilized ovules mature into seeds.

The ovary wall enlarges and matures into a fruit.

ROOT POINTS

1. **Reproduction** ensures continuity of species by producing **new individuals** generation after generation.
2. **Sexual reproduction** enables the creation of new variants, which enhances survival advantages.
3. **Flowers** are the specialised **reproductive organs** of angiosperms responsible for seed formation.
4. **Fruits and seeds** are the **final products** formed after fertilisation in flowering plants.
5. **Androecium** is the **male reproductive** whorl consisting of stamens that produce pollen grains.
6. **Gynoecium** is the **female reproductive** whorl consisting of pistils containing ovules.
7. Each anther contains **four microsporangia** where pollen grains are produced.
8. The **microsporangium** wall has four protective and nutritive layers surrounding pollen tissue.
9. **Pollen mother cells** undergo **meiosis** to produce haploid microspores in tetrads.
10. **Microsporogenesis** is the meiotic process of forming microspores from PMCs.
11. Pollen grains represent the **male gametophyte** carrying male reproductive cells.
11. **Gynoecium** may be monocarpellary with one carpel or multicarpellary with many carpels.
13. **Carpels** may be fused together as syncarpous or remain free as apocarpous.
14. **Micropyle** is a minute opening in ovule through which pollen tube enters.
15. **Embryo sac** is the female gametophyte developed inside the nucellus of ovule.
16. **Mature embryo sac** is **7-celled and 8-nucleate** with organised reproductive cells.
17. **Egg apparatus** consists of **one egg cell and two synergids** at micropylar end.
18. **Filiform apparatus** in synergids guides the pollen tube towards the egg apparatus.
19. **Cleistogamous flowers** remain **closed** and ensure assured self-pollination and seed set.
20. **Geitonogamy** is pollination between different flowers of the same plant.
21. **Xenogamy** is pollination between flowers of genetically different plants of same species.
22. **Animal-pollinated** flowers are colourful, fragrant and nectar-rich to attract pollinators.
23. **Pollen tube** enters the ovule through micropyle and reaches synergid for gamete release.

24. **Syngamy** is fusion of one male gamete with egg cell forming **diploid zygote**.
25. **Triple fusion** forms triploid primary endosperm nucleus by fusion of **three nuclei**.
26. **Double fertilisation** is unique to angiosperms because **syngamy and triple fusion** occur together.
27. The ovule of an angiosperm is technically equivalent to **megasporangium**. [NEET-2016]
28. Pollination in water hyacinth and water lily is brought about by the agency of **insects or wind**. [NEET-2016]
29. In majority of angiosperms **reduction division occurs in the megaspore mother cells**. [NEET-2016]
30. Proximal end of the filament of stamen is attached to the **thalamus or petal**. [NEET-2016]
31. Seed formation without fertilisation in flowering plants involves the process of **apomixis**. [NEET-2016]
32. Double fertilization is exhibited by **angiosperms**. [NEET-2017]
33. A dioecious flowering plant prevents both **autogamy and geitonogamy**. [NEET-2017]
34. Flowers which have single ovule in the ovary and are packed into inflorescence are usually pollinated by **wind**. [NEET-2017]
35. Attractants and rewards are required for **entomophily**. [NEET-2017]
36. Functional megaspore in an angiosperm develops into an **hydrophily**. [NEET-2017]
37. **Persistent nucellus** in the seed is known as **Perisperm**. [NEET-2019]
38. **Extrusion of second polar body** from egg nucleus occurs **after entry of sperm but before fertilization**. [NEET-2019]
39. The phenomenon in which the **female gamete develops into embryo without fertilization** in some plants is known as **Parthenogenesis**. [NEET-2019]
40. The **fate of male gametes** discharged in the synergids is that **one fuses with the egg and other fuses with central cell nuclei**. [NEET-2019]
41. A typical angiosperm embryo sac at maturity is **8 nucleate and 7-celled**. [NEET-2021]
42. In the seeds of cereals, the outer covering of endosperm separates the embryo by a protein rich layer called - **aleurone layer**. [NEET-2025]