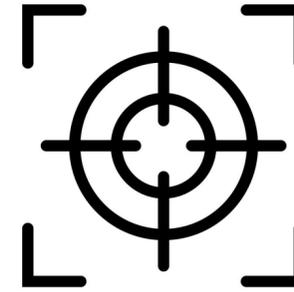


Topic 15: Reproduction in Plants

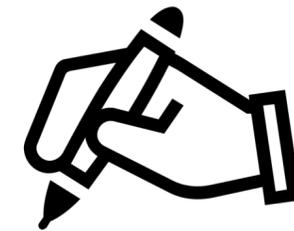


Chapter Analysis



FOCUS

- straightforward chapter



EXAM

- commonly tested in MCQ



WEIGHTAGE

- Constitute to around 0.5% in Paper 2 in the past 5 years

Key Concept

flower structures

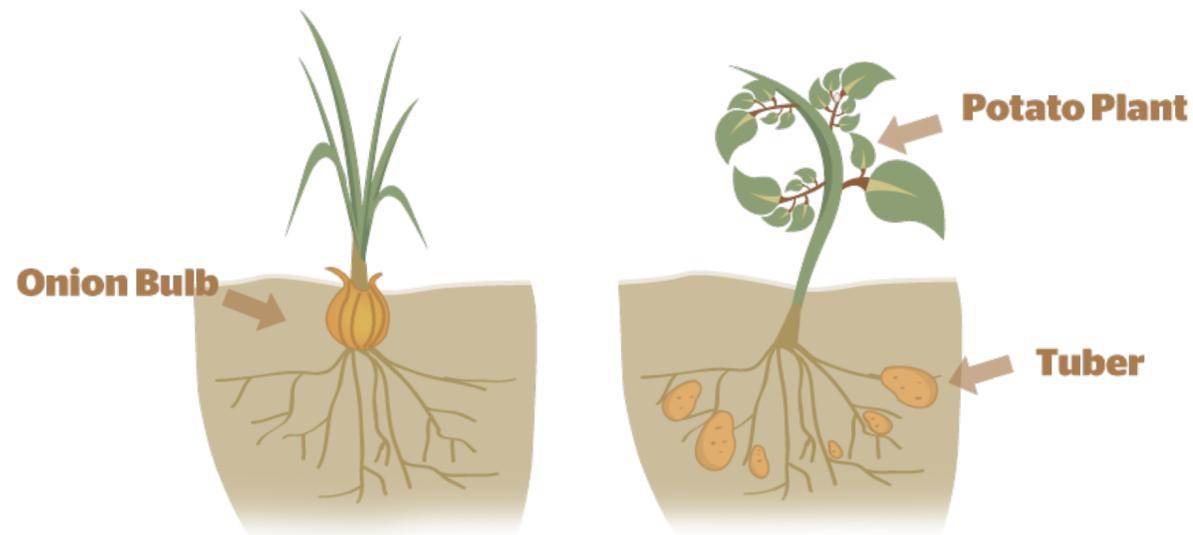
pollination

fertilisation

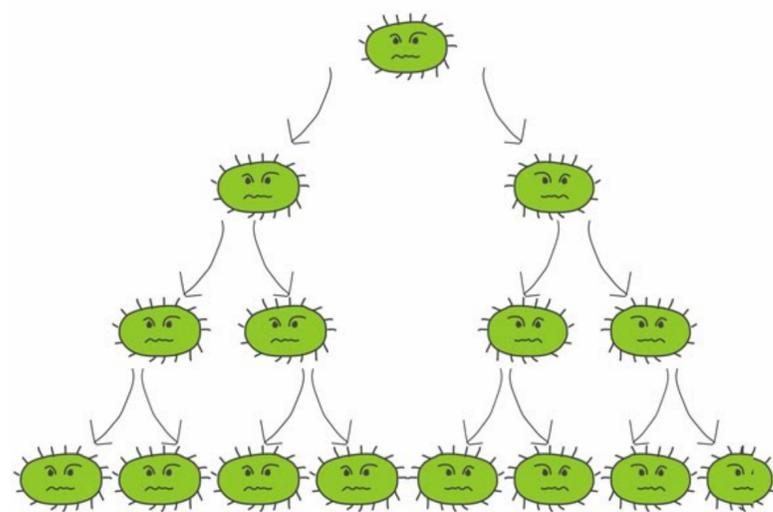


reproduction

asexual reproduction



- Reproduction is the biological process by which new organisms are produced to ensure the perpetuation of the species.
- Two type of reproduction:
 1. **Asexual reproduction** is the process of producing a **genetically identical offspring** from one parent **without the fusion of gametes**.



	Advantages	Disadvantages
Asexual reproduction	<ul style="list-style-type: none">- Only one parent required as fusion of gametes is not required.- All beneficial qualities are passed onto the offspring.- Faster method of producing offspring as compared with sexual reproduction.- Since organisms are already in a suitable habitat, they can colonise the area rapidly.	<ul style="list-style-type: none">- No genetic variation in the offspring. Hence, species are may be wiped out if not well adapted to changes in the environment.

Reproduction

sexual reproduction

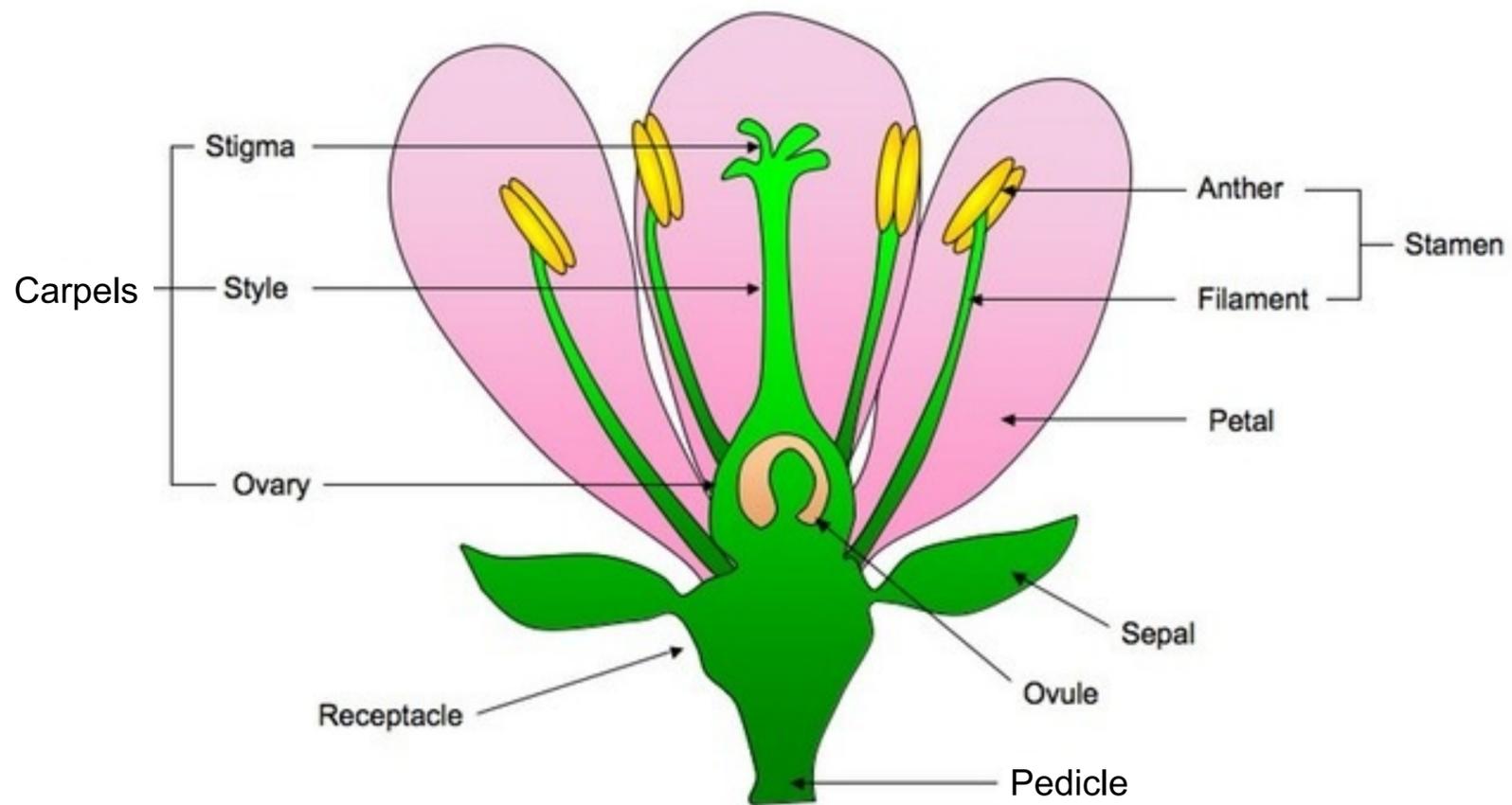


2. **Sexual reproduction** is the process involving the **fusion of gametes**, one from each parent, to form a **zygote** during **fertilisation**. The outcome is genetically dissimilar offspring.



	Advantages	Disadvantages
Sexual reproduction	<ul style="list-style-type: none">- Offspring may inherit beneficial qualities from both parents.- There is greater genetic variation in the offspring, thus species can be better adapted to changes in the environment.	<ul style="list-style-type: none">- Two parents are required (except in plants with bisexual flowers) as fusion of gametes is required- Slower method of producing offspring as compared to asexual reproduction

structure of a flower plant



structure of a typical insect-pollinated flower

Sepal	<ul style="list-style-type: none"> Modified leaves which are found on the outermost ring of floral leaves. They enclose and protect the flower when it is in bud stage.
Petal	<ul style="list-style-type: none"> Modified leaves which form the most conspicuous part of the flower. - They are large and brightly coloured in insect-pollinated plants - Form a platform for insects to land on.
Anther	<ul style="list-style-type: none"> Male reproductive organs in plants The anther consists of two lobes and a vascular bundle Each lobe contains two pollen sacs, which contain pollen grains (male gametes)
Filament	Stalk that holds the anther in a suitable position to disperse pollen
Carpels	<ul style="list-style-type: none"> Female reproductive organ in plants. Stigma: Receptor of pollen grains. Secretes a sugary fluid that stimulates germination of pollen grains. Style: Holds the stigma in position to trap pollen grains. Ovary: Each ovary contains one or more ovules, which contains female gametes

Pollination

self pollination

Pollination is the transfer of pollen grains from the anther to the stigma, enabling fertilisation.

Self pollination: transfer of pollen grains from the anther to the stigma of the same flower or from the anther of a flower to the stigma of another flower on the same plant.

It is favoured when:

- Bisexual flowers with anthers and stigma maturing at the same time
- Stigma being located directly below the anthers, allowing pollen grains to fall onto it



Advantages	Disadvantages
Not dependent on external agents of pollination such as insects or wind	There is less genetic variation, hence the offspring is less adapted to environmental changes. (this is NOT the same as asexual reproduction. There is fusion of gamete thus offspring is NOT genetically similar to parents)
Less wastage of pollen and energy. During wind and insect pollination, a great number of pollen grains are lost as only a few pollen grains come into contact with a stigma of a flower of the same species.	
Only one parent plant is required.	

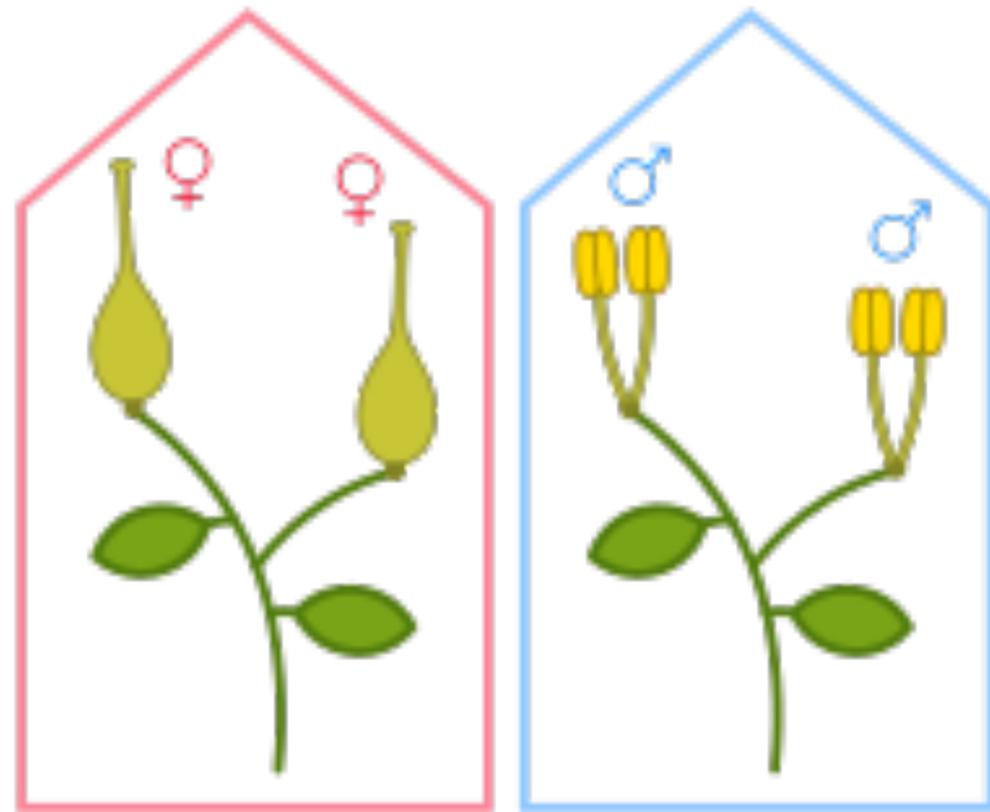
Pollination

cross pollination

cross pollination: transfer of pollen grains from the anther of a flower to the stigma of a flower of another plant belonging to the same species.

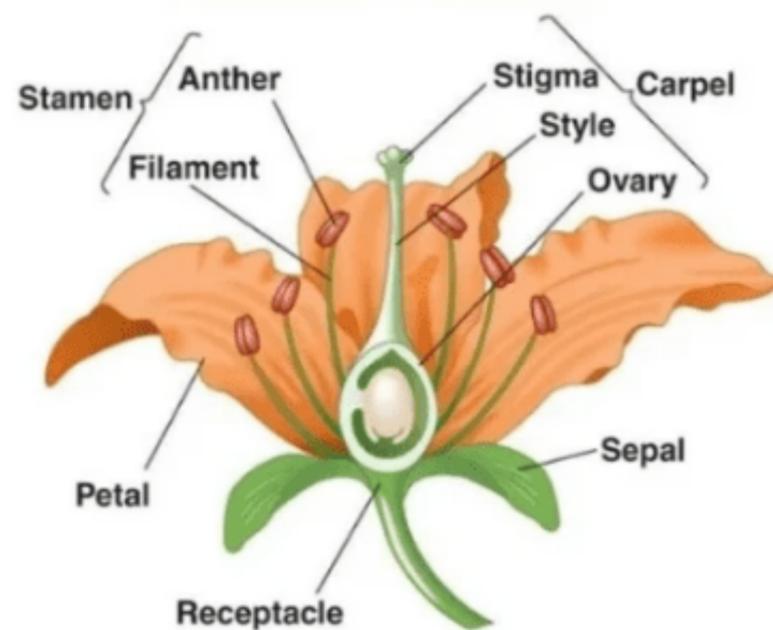
It is favoured when:

- Plants bear only male or female flowers, thus self pollination is not possible
- In plants with bisexual flowers, the anthers and the stigmas mature at different times.
- The stigma and anthers are located very far away.

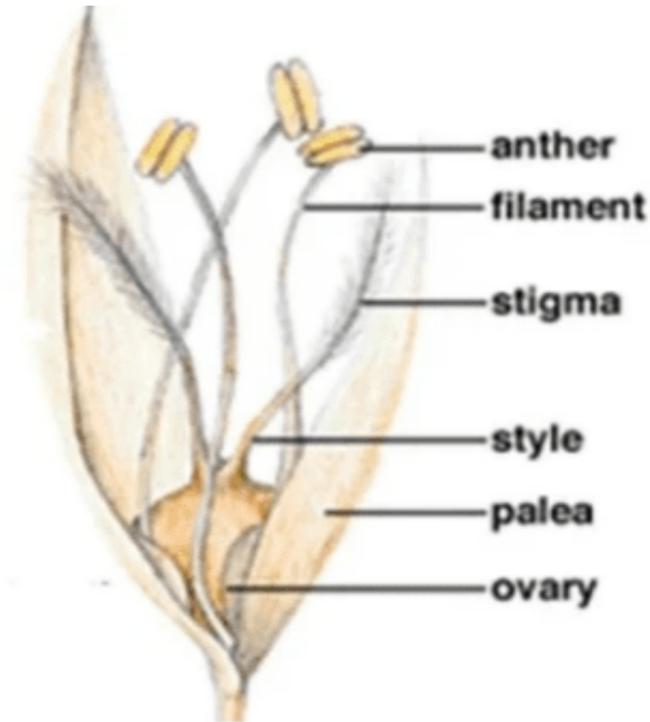


Advantages	Disadvantages
Greater genetic variation, hence the offspring has a higher chance of surviving environmental changes.	Energy-consuming – lots of energy is required to make large amounts of pollen grains.
	A great number of pollen grains are wasted due to the randomness of the dispersal methods.
Offspring may have inherited beneficial qualities from both parents.	External agents of pollination i.e. wind, insects are required.
	Two parent plants are required.

mechanism of cross pollination



Insect-pollinated flower



Wind-pollinated flower

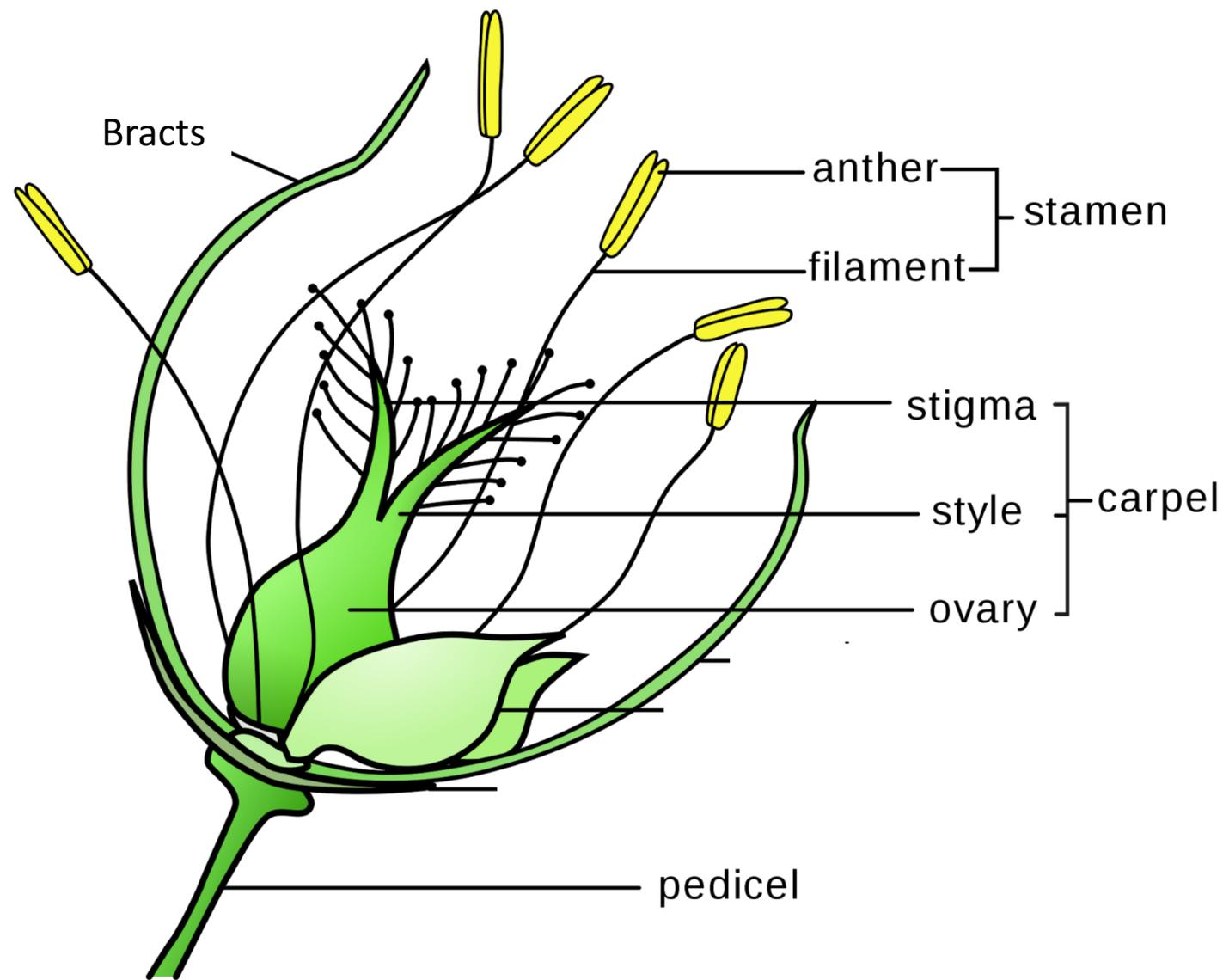
1. Insect-pollination

Insect such as bees and butterfly enters the flower for the nectar, pollen grains from the anthers stick onto the insect. When they visit other flowers, the will be transferred to the next flower sticky stigma.

2. Wind-pollination

Wind-pollinated flowers have their pollen carried away by the wind when the exposed anthers shake in the wind. The pollen grains may come into contact with large feathery stigmas of another flower, they would be trapped.

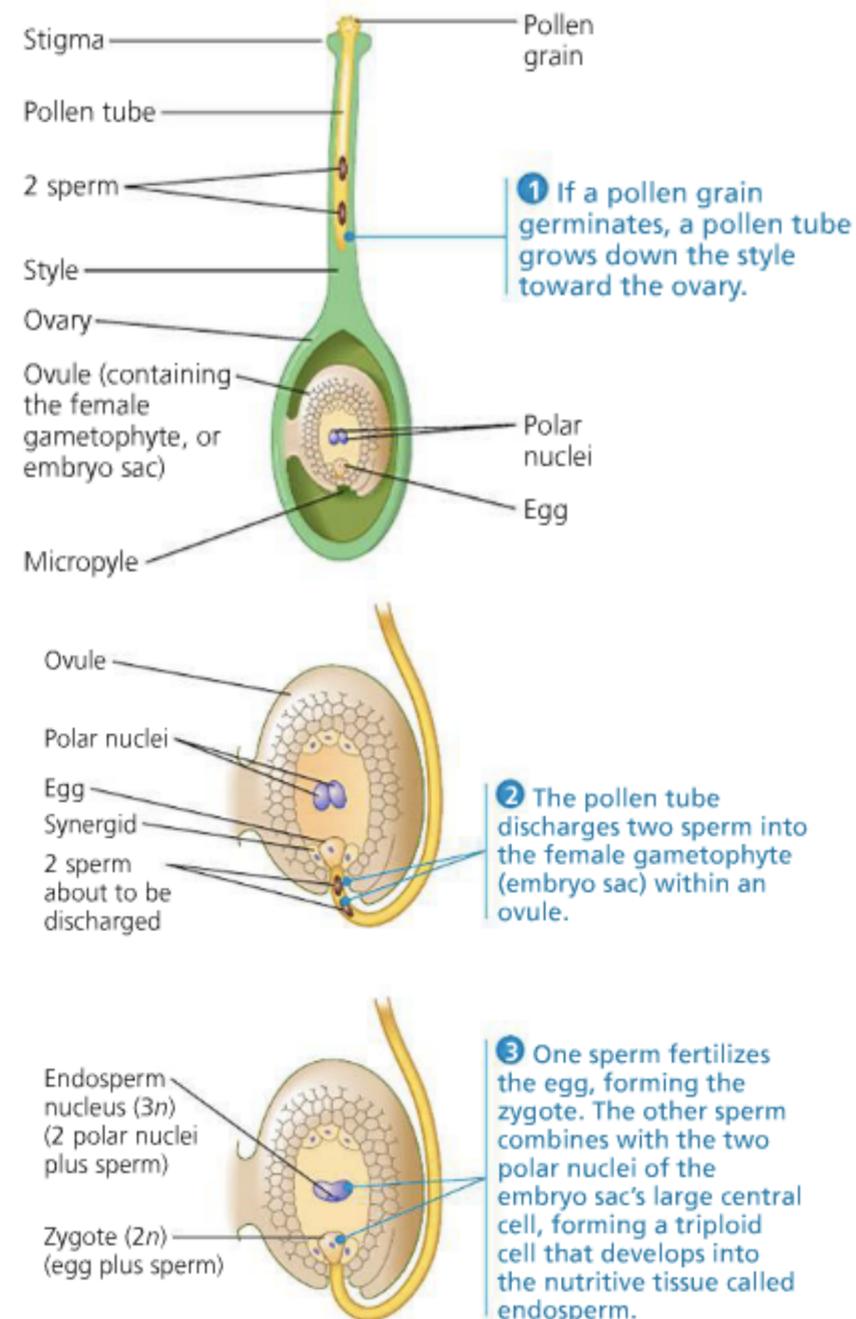
insect pollinated vs wind pollinated



structure of a typical insect-pollinated flower

	Insect-pollinated Flowers	Wind-pollinated Flowers
Petals	Large, brightly-coloured petals	Small and dull petals, flower parts are protected by modified leaves called bracts
Scent	Flowers are fragrant or sweet smelling	Flowers are scentless
Nectar	Present	Absent
Nectar guide (lines visible to insects, guiding them to nectar)	Present	Absent
Stamen	Not pendulous and do not protrude out of the flower	long pendulous filaments and protruding anthers, so pollen grains are easily shaken off by the wind
Stigma	Small and compact, do not protrude out of the flower	large, feathery and protrude out of the flower to provide a large surface area to trap pollen.
Pollen grains	Fairly abundant large and sticky with rough surface so it can readily stick to body insects	Very abundant, small and light to be carried by the wind

fertilisation in plants



Fertilisation: The fusion of nuclei of the male gamete (pollen) and the female gamete (ovule)

1. After pollination, the **pollen grains germinate** in response to the **sugary fluid secreted by stigma**.
2. A **pollen tube** grows out from each pollen grain. The cytoplasm and **the two nuclei** of the pollen grain, namely generative nucleus and pollen tube nucleus, pass into the pollen tube
3. **Pollen tube secretes enzymes** to digest the surrounding tissue of the stigma and style.
4. The **generative nucleus** divides to form **two male gametes**.
5. The pollen tube **enters the ovule in the ovary** through the micropyle.
6. Within the ovule, the tip of the pollen tubes **absorbs sap and bursts**, releasing the two male gametes.
7. One male gamete **fuses** with the nucleus of the ovum to form the **zygote**, while the other male gamete fuses with the definitive nucleus to form the endosperm nucleus
8. The **ovule** will develop into a **seed** and the **ovary** will develop into a **fruit**.

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