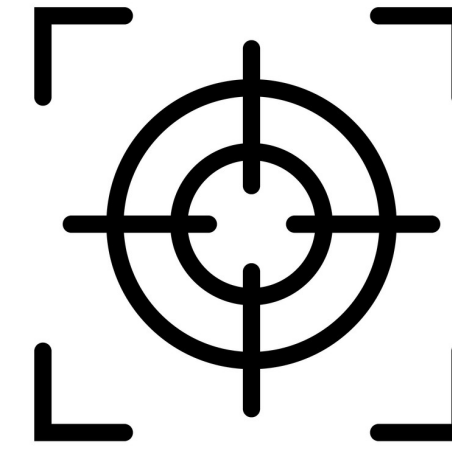


# Topic 12: Reproduction in Plants

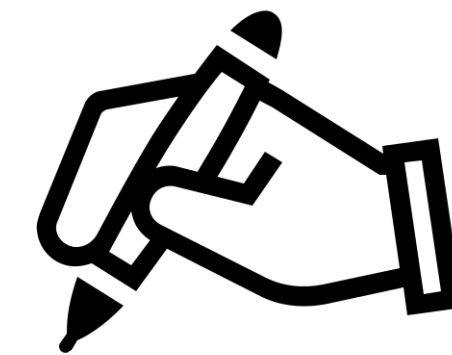


# Chapter Analysis



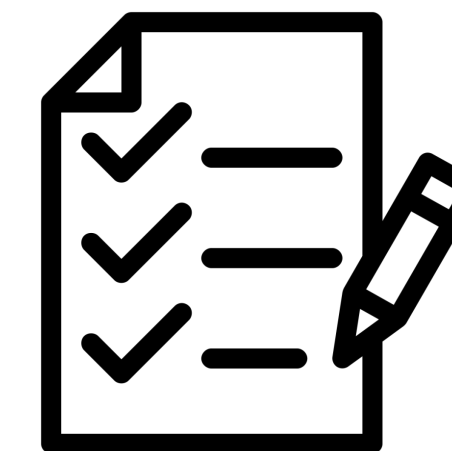
## **FOCUS**

- straightforward chapter



## **EXAM**

- commonly tested in MCQ and paper 2
- tested in section B once in the past 5 years



## **WEIGHTAGE**

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

**Key Concept**

**flower structures**

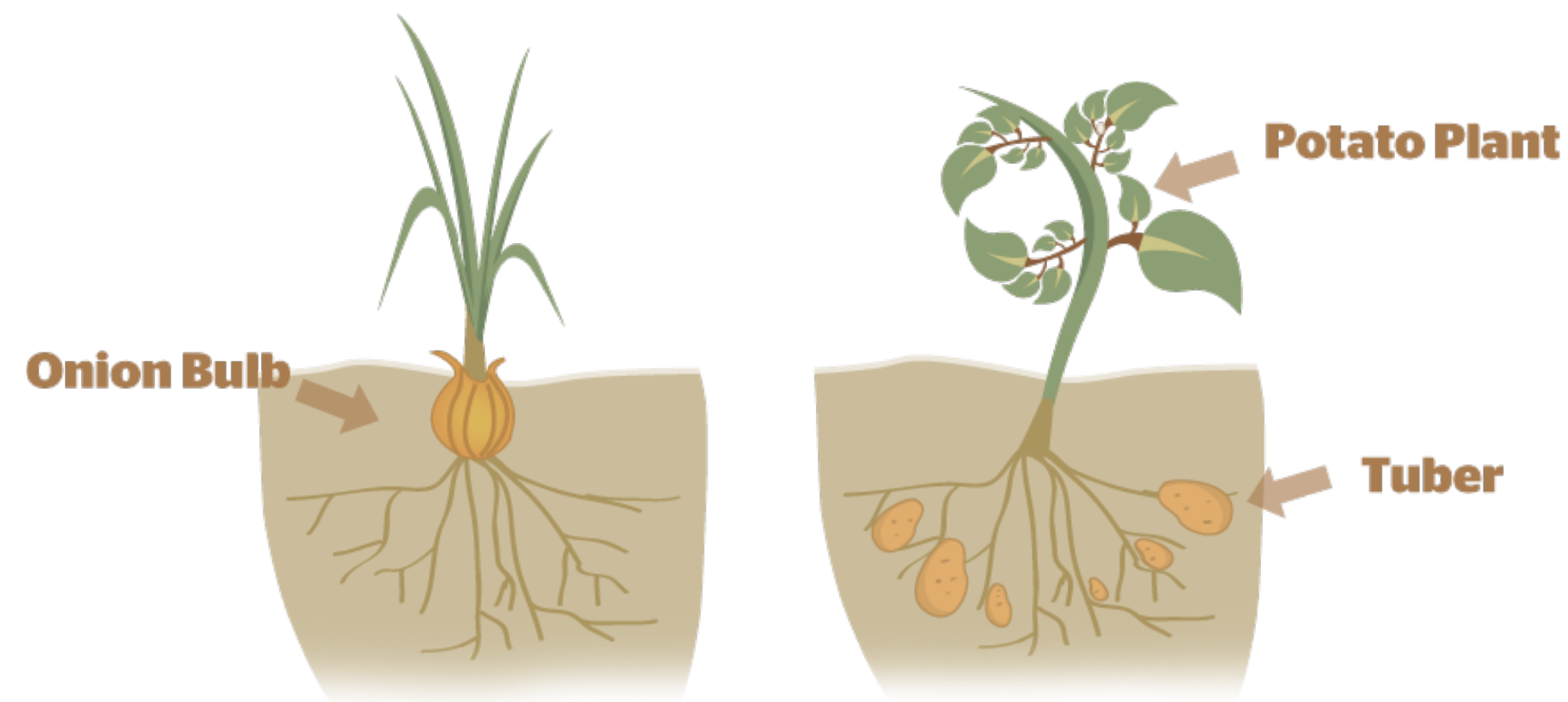
**pollination**

**fertilisation**

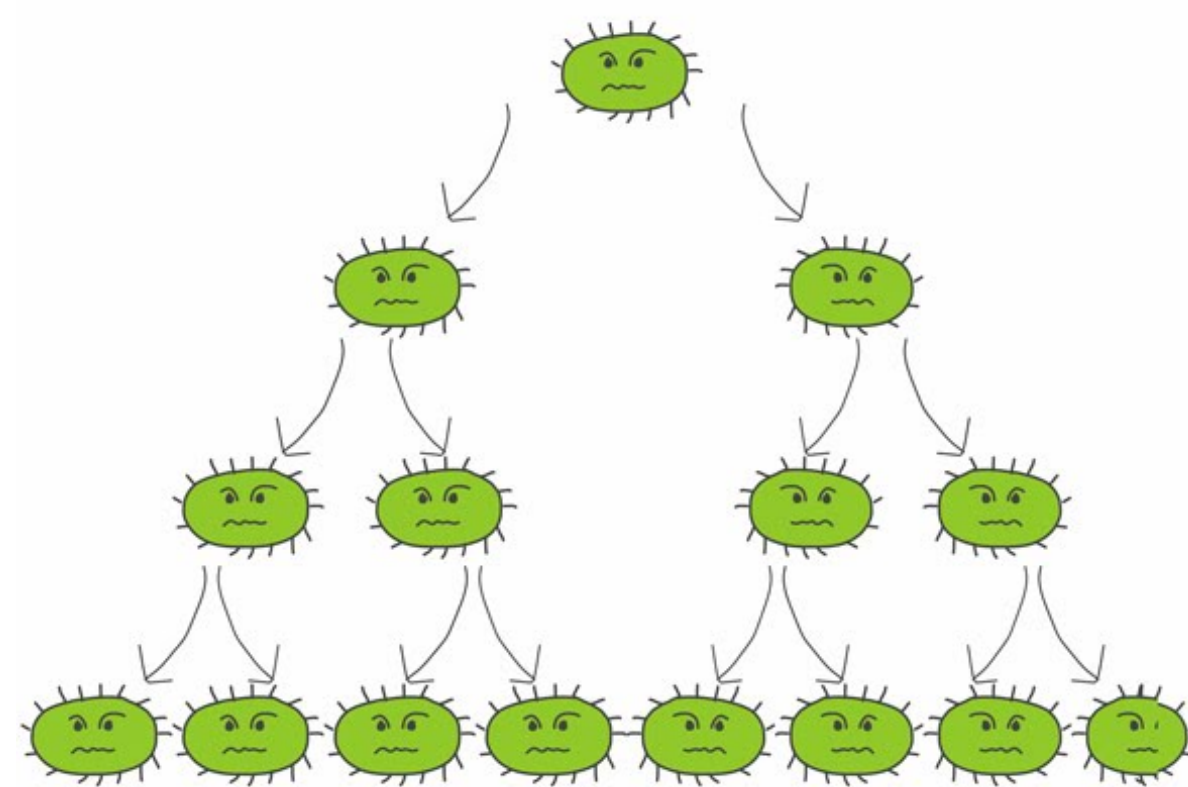


# reproduction

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

# 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.

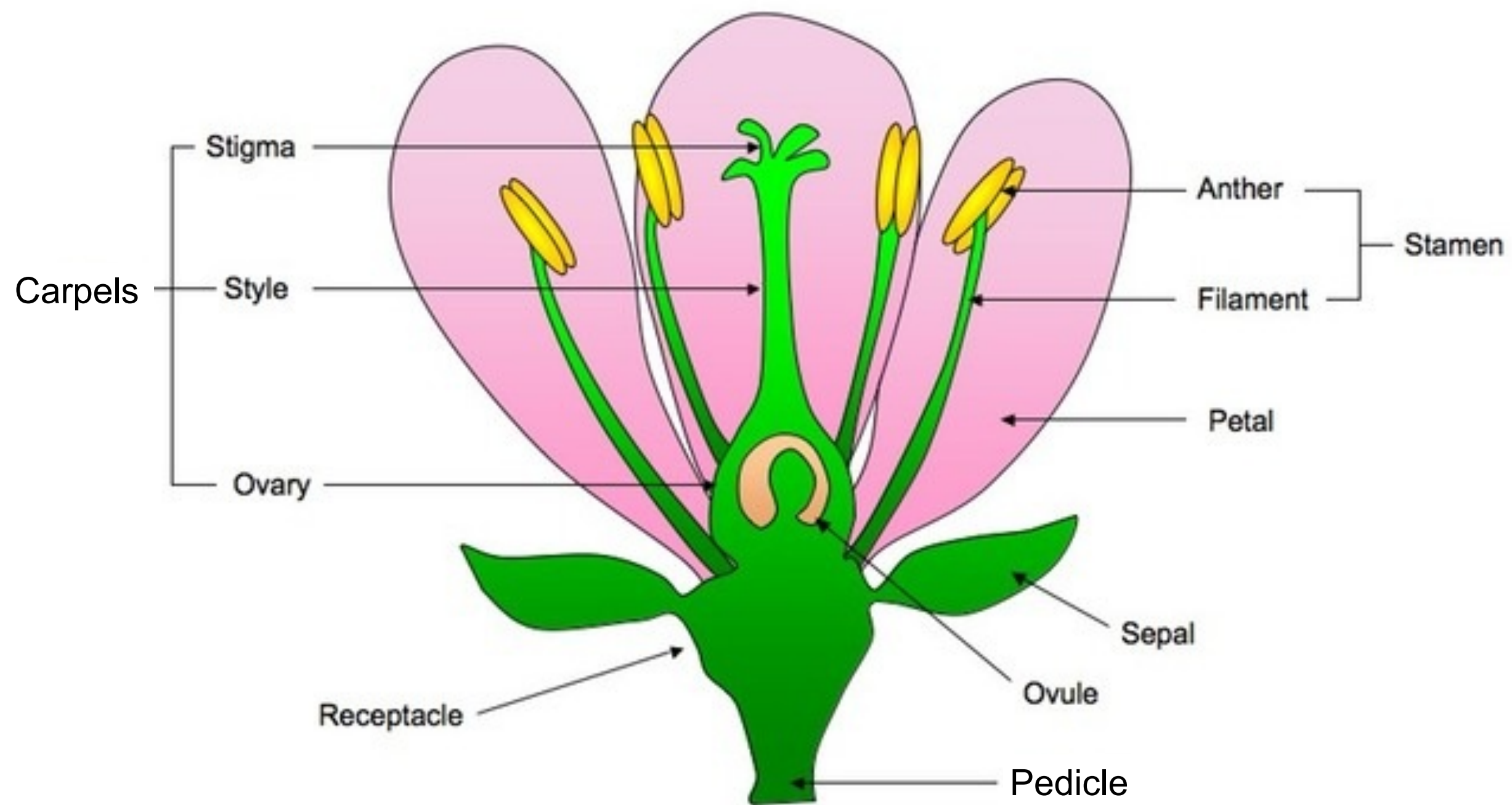
	Advantages	Disadvantages
<b>Sexual reproduction</b>	<ul style="list-style-type: none"><li>- Offspring may inherit <b>beneficial qualities from both parents</b>.</li><li>- There is <b>greater genetic variation</b> in the offspring, thus species can be <b>better adapted</b> to changes in the environment.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



### Gametes

- Gametes have half the number of chromosomes as compared to normal cell which are diploid
- For example, a human cell has **diploid number** of chromosomes, **23 pairs** of chromosomes, **46 chromosomes**
- human gamete has half the chromosomes, 23 chromosomes
- male gametes and female gamete fuse to restore the normal number of chromosomes

# structure of a flower plant



**structure of a typical insect-pollinated flower**

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

# 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.	

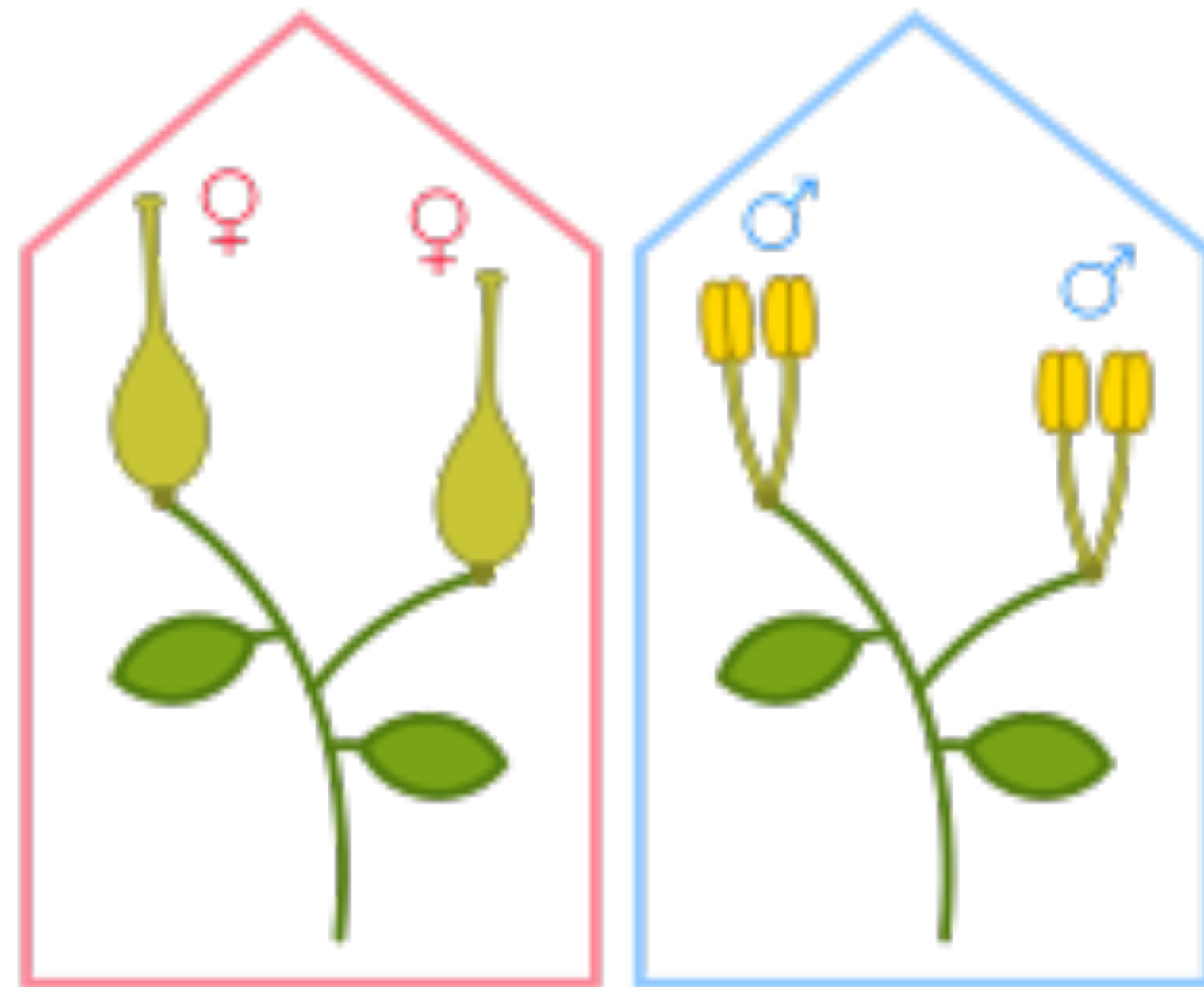
# Pollination

## 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:

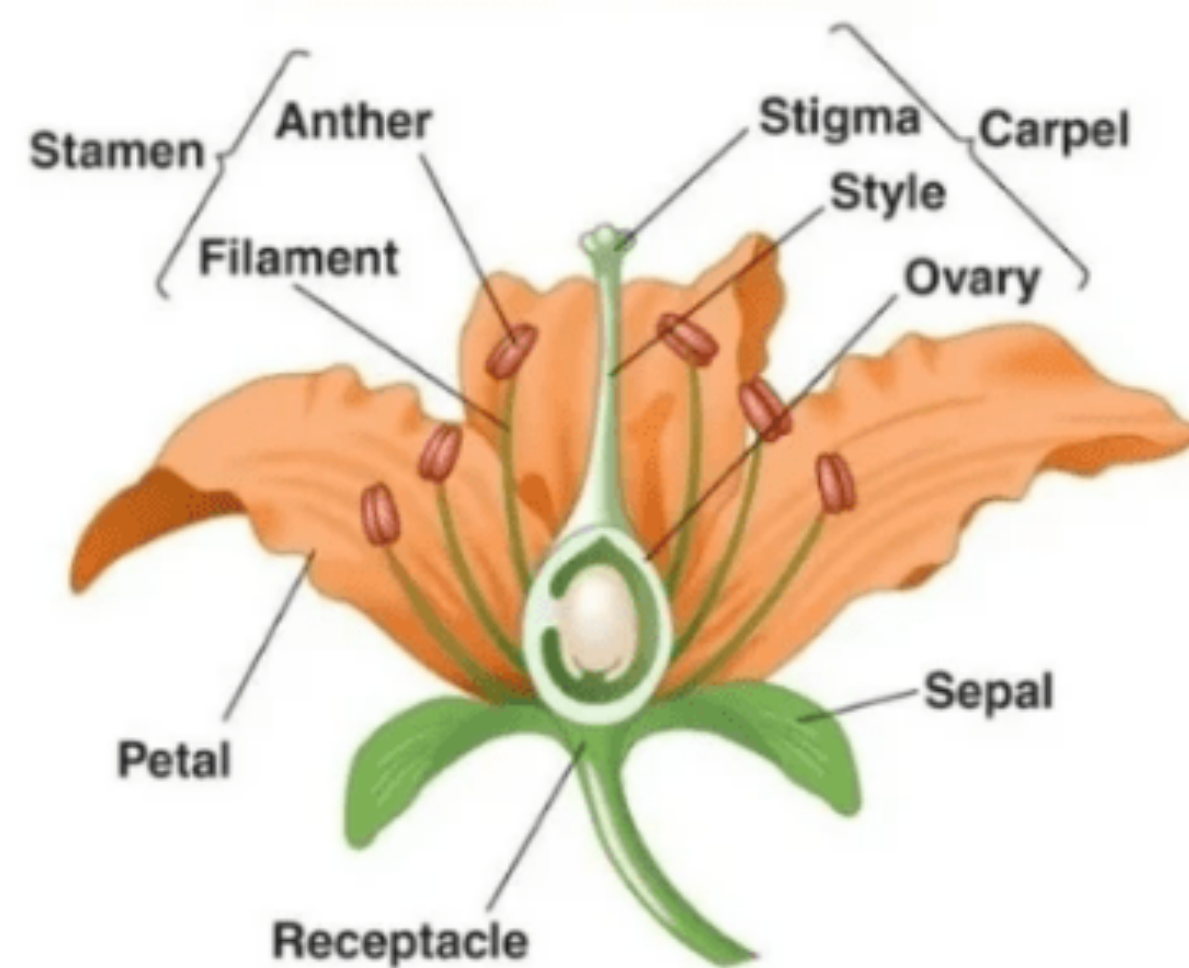
- Plants bear only male or female flowers, thus self pollination is not possible
- In plants with bisexual flowers, the anthers and the stigmas mature at different times.
- The stigma and anthers are located very far away.



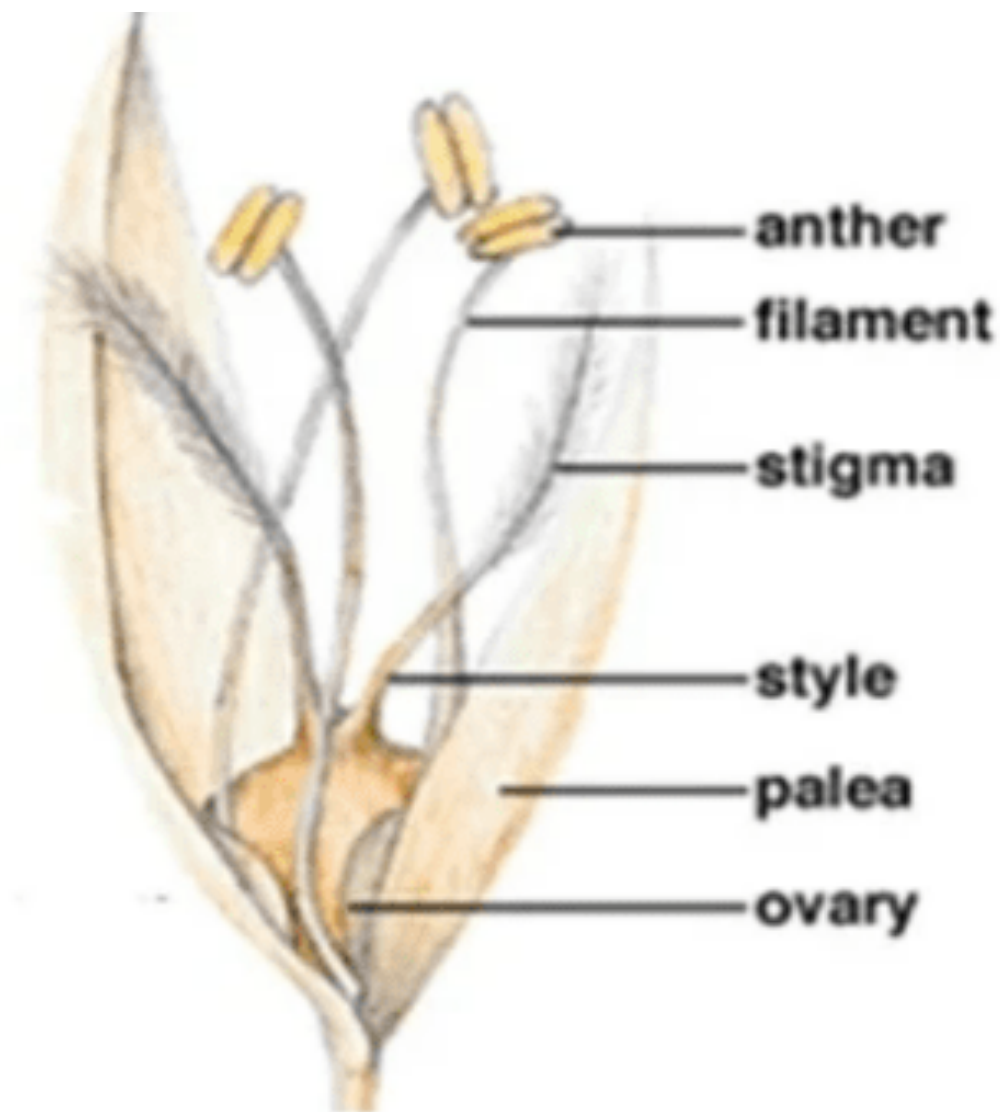
Advantages	Disadvantages
Greater genetic variation, hence the offspring has a higher chance of surviving environmental changes.	Energy-consuming – lots of energy is required to make large amounts of pollen grains.
	A great number of pollen grains are wasted due to the randomness of the dispersal methods.
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**

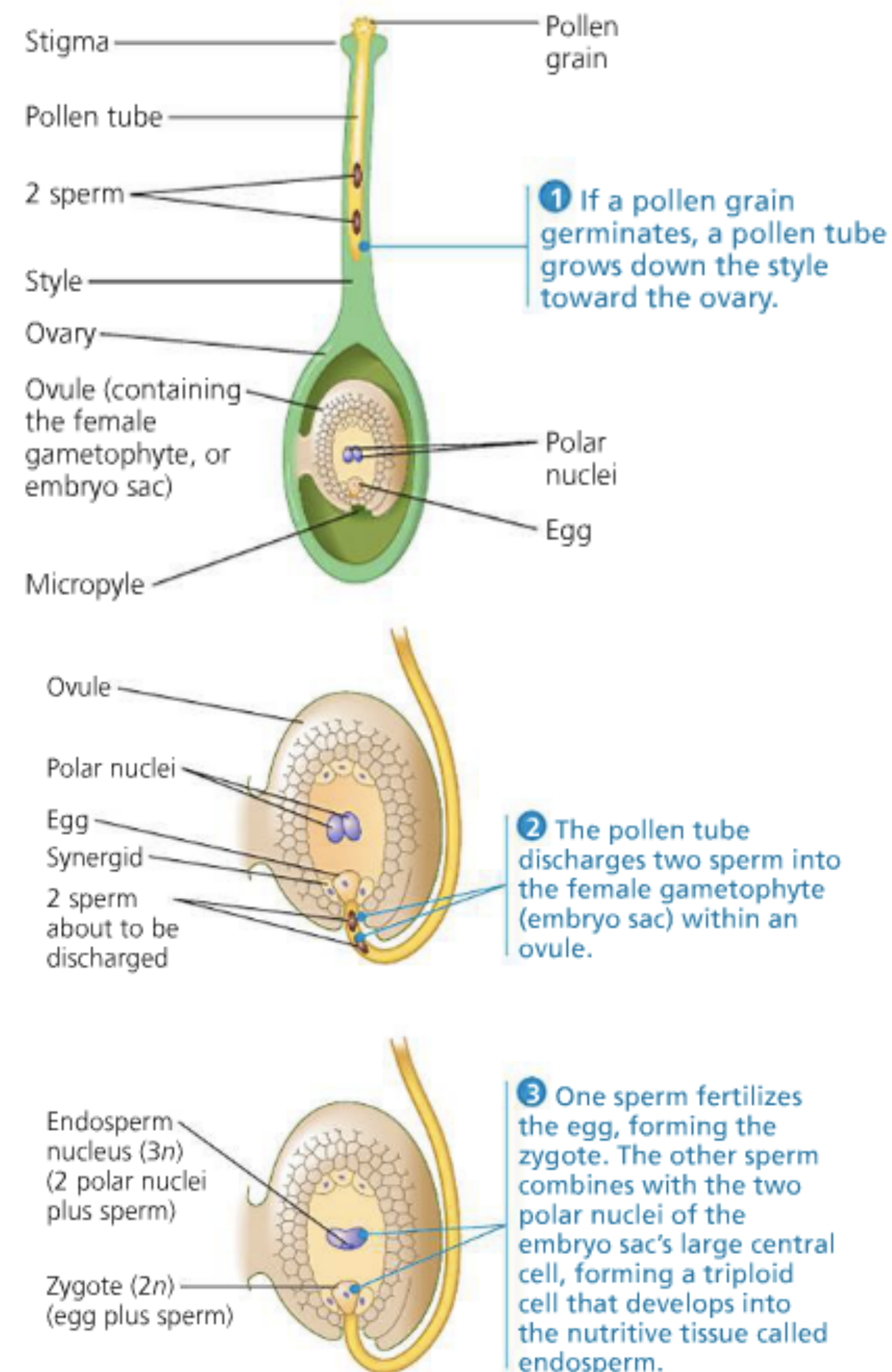
## 1. Insect-pollination

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.

# 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 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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