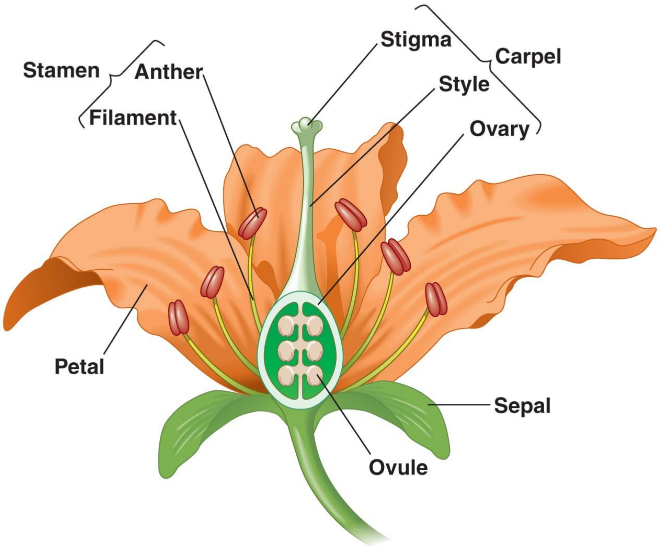
OCR (B) Biology A-level

4.4 Plant Reproduction

Notes

Structure of flowers



The image above illustrates a generalised **flower structure**. The **stam**en is the male part of the plant consisting of a long filament with **anthers** at the end which are involved in the production of male games in the form of pollen grains. The carpel is the female part of the plant which is the site of **ovule development**.

The process in which pollen grains produced by anthers are transferred to female reproductive organs of a plant in the form of stigma is known as **pollination.** Pollination can either occur with the help of **wind or insects**. The product of fertilisation is the seed which then develops into a fruit.

There are various differences between insect pollinated and wind pollinated plants, for instance:

- **Insect pollinated plants need** to **attract insects** therefore they have bright coloured **petals, a sweet smell and contain nectar**.
- **Wind pollinated plants** have a large amount of **light and dry pollen** as wind-carried pollen doesn't always reach the plant, as opposed to insect pollinated plants
- The position of **anthers and stigma** varies between insect and wind pollinated plants, the anthers of wind pollinated plants are located o**utside the flower and are loose for ease of pollination** whereas those of insect pollinated plants and **inside the flower and are arranged in a tight manner to increase the change of brushing against an insect**
- Both insect pollinated and wind pollinated plants have **sticky stigma**, however the stigma of wind pollinated plants is **more flexible** as it needs to catch drifting pollen

Cross and self-pollination

There are two forms of pollination – **cross and self-pollination**.

Self-pollination is a type of pollination where the pollen front the anthers of a plant is transferred to the stigma of a flower of the same plant.

Whereas in **cross pollination**, the pollen from anthers of one plant is transferred to a stigma of a flower of another plant. However, self-fertilised plants display a **lesser degree of genetic variation**, which can be advantageous in stable environments as the plants which are well suited to that particular environment pass their alleles on.

Flowers of a plant are adapted for cross pollination as they attract insects which transfer the pollen from one plant to another.

For example, in order for the bees to feed on the sweet nectar located at the base of the female part of a flower, then need to enter the flower which causes them to pick up pollen from anthers. As they enter another flower, the pollen brushes against the stigma of another plant, thus leading to cross pollination.

Wind pollinated plants are adapted for cross-pollination as their anthers and stigma are located on the outside of the flower for ease of pollination.

Double fertilisation

Plant fertilisation occurs as following:

- **Pollen grain** composed of the **pollen tube cell and the generative cell** adheres to the stigma, where it subsequently germinates to produce **a pollen tube**
- The pollen tube grows down the **style**, secreting a **digestive enzyme** which digests the surrounding tissue and use it as a source of nutrients
- The pollen tube grows through a gap between the integuments known as the **micropyle** into the **embryo sac**
- The generative cell of the pollen divides to produce **two sperm cells** which enter the embryo sac
- One of the male gametes fuses with the female nucleus to form a **zygote**
- The other male gamete fuses with **two polar nuclei** to form an **endosperm nucleus** which serves as a source of nutrients for the embryo
- The fertilised ovule divides by mitosis to form the embryo consisting of the developing shoot known as the **plumule**, developing root known as the **radicle** and

one or two cotyledons. The integuments become the **seed coat**, the ovule becomes the **seed** and the ovary becomes **the fruit**.

Germination and plant growth regulation

In order to enable the seed to germinate, the **food store** needs to be mobilised. Apart from the food source, the requirements for successful germination include a **suitable temperature** which is the optimum temperature of the enzymes involved in the process, as well as a **good water and oxygen supply.**

Insoluble food reserves need to be broken down with the help of enzymes so that they can be transported in water to growing parts of the **plumule and radicle**. During the initial developmental stages of the seed, it takes up a **large amount of water** which leads to swelling and enzyme activation. Swelling leads to seed **coat rupture** which in turn enables further development of radicle and plumule.

Starch which is used as the food store is broken down into maltose with the help of amylase, and subsequently transported to growing parts of the plant. In the case of the broad bean, the **cotyledons** remain underground. As development progresses, the plumule which grows upwards breaks through the soil in a bent manner to **avoid damage.** Once the plumule breaks through the soil, it can begin to **photosynthesise** and becomes the main source of food for the plant.

Plant growth responses can be triggered by **plant growth regulators**. Examples include **auxins** which promote cell elongation, **gibberellins** which promote seed germination and stem growth, **abscisic acid** which inhibits seed germination and causes closing of stomata and **ethane** which is a gas that promotes ripening of fruit.

Gibberellins have various **commercial uses**, for instance they are used to delay senescence in citrus fruits, for elongation of apples in combination with cytokinins, for elongation of grape stalks, in brewing of beer for production of malt, to increase the yield of sugar cane, to speed up seed formation in young conifer trees and to prevent lodging.