



# Plant Structure

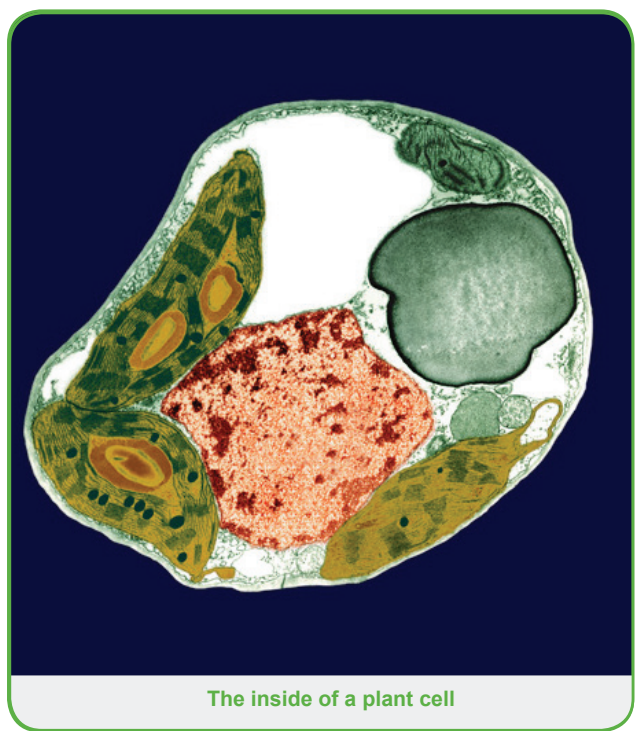
BIOLOGY • PLANTS • PLANT STRUCTURE

## Section 1: Plants

### • What are plants made of?

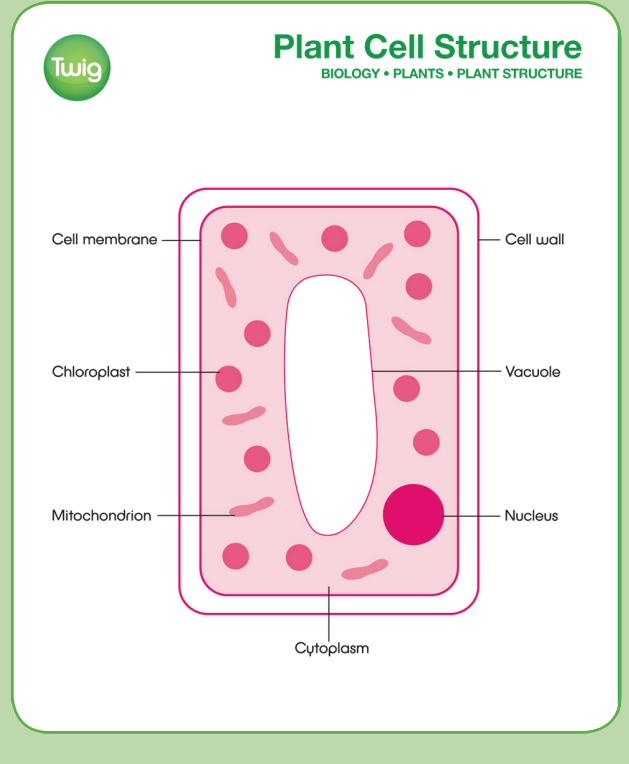
Like all living organisms plants are constructed from cells. Plants cells are similar to other cells in that they consist of cytoplasm enclosed within a membrane. Like many other cell types they also contain organelles such as a nucleus and mitochondria. However, the cells of plants are unique in that they often contain large permanent vacuoles and chloroplasts, as well as being enclosed within a cell wall made of cellulose.

- Suggested Film
  - FactPack: Amazing Plants



The inside of a plant cell

### DIAGRAM 01:



### Extension Question

Q1. What are chloroplasts?

Chloroplasts are tiny, green organelles found inside the cells of green plant tissue. Chloroplasts contain the pigment chlorophyll, which can trap the energy from sunlight and use it to drive the process of photosynthesis. This is how plants make food.

### • Are all plant cells the same?

Plants are multi-cellular organisms and their cells are specialised according to specific functions. For example, leaf cells contain lots of chloroplasts for photosynthesis, and root hair cells have projections in order to increase their surface area for water uptake. There are lots of different types of plant cells, which are needed to construct a large multi-cellular plant. Some are involved in support, some in the transport of materials, and some in gas exchange with the environment.

#### Extension Question

##### Q2. How do plants support themselves?

Plants support themselves in a number of ways. For example, cell walls help to provide rigidity to plant tissues and the turgor pressure inside cells adds further support. The veins in plants can also help to keep the stem upright and prevent the leaves from drooping.



Plants use sunlight energy, carbon dioxide and water to make their own food. This process is called photosynthesis

### • What are the key organs of a plant?

The key organs in plants are the roots, stem, leaves and flowers. The roots anchor the plant in the ground and absorb water and minerals for the plant. The stem holds the leaves and flowers up, as well as containing the tissues which conduct materials up and down the plant. Photosynthesis takes place in the leaves, and the flowers are the reproductive parts of the organism.

#### Extension Question

##### Q3. What materials are transported up and down the stem?

Water and minerals from the soil are transported up the stem to the leaves where they are used in the production of food, such as sugar and amino acids. These food substances are then transported all over the plant to the tissues that need them for growth and respiration.

## Section 2: Leaves and Flowers

### • How is the leaf adapted to its function?

Leaves are the site of food production for a plant. To make food by photosynthesis plants need light, water and carbon dioxide.

Leaves are thin and have a large surface area to volume ratio to trap light and absorb carbon dioxide from the atmosphere. They have small pores called stomata on the lower surface through which gas exchange can occur and a spongy tissue inside to aid the rate of gas exchange. The cells within the leaves are packed with chloroplasts and water is provided by a system of veins, which also serve to take the food produced to other parts of the plant.

#### • Suggested Film

– **Parts of the Plant: Leaves**

**Extension Question****Q4. Why do leaves have a waxy cuticle?**

Being thin and having a large surface area means plants can absorb sunlight and exchange gases rapidly with the atmosphere. However, it also means plants are prone to lose water by evaporation (called transpiration). A waxy cuticle helps to minimise this water loss, and plants in dry habitats often have very waxy leaves.

- How is the root adapted to its function?

Roots need to anchor the plant firmly in the ground and then draw up the water and minerals that the plant needs to manufacture food. To do this, roots tend to spread out widely throughout the soil particles, and present a large surface area to the soil water and its dissolved minerals. Some cells, called root hair cells, have long extensions, which further help to increase the rate of uptake by both diffusion and active transport.

- Suggested Film

- Root Hairs

**Extension Question****Q5. What is the difference between diffusion and active transport?**

Diffusion is the movement of particles down their concentration gradient. This is a passive process and does not need the root cells to provide additional energy. So if there is a higher concentration of a particular mineral in the soil than in the root, diffusion into the root cells will take place. Sometimes though, especially in infertile soils, the concentration of some minerals can be very low in the soil and so the plant uses active transport to pump minerals into the root. This requires energy provided by the root cells through respiration.



Roots absorb water and nutrients. They also attach the plant to the soil

- What is the function of flowers?



The male and female reproductive parts of a flower

Flowers are the reproductive parts of plants. Inside the flower are the reproductive organs, including the male stamens and female ovary. Anthers on the stamen produce pollen, which contains the male gamete and which must 'pollinate' a flower by landing on the stigma of the same or a different plant. Some plants use the wind to distribute the pollen, others rely on insects. Once a flower has been pollinated, the pollen grain grows a tube down to the ovary where it 'fertilises' a female ovule, which in turn contains the female gamete. This fertilised ovule then develops into a seed and the ovary turns into a fruit.

- Suggested Film

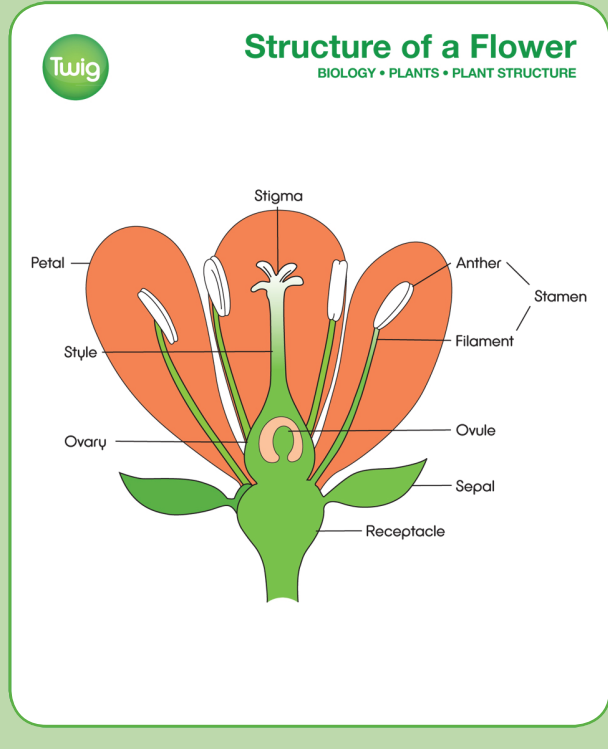
- Parts of the Plant: Flowers

**Extension Question**

Q6. What is the difference between self and cross-pollination?

Self-pollination occurs when a pollen grain lands on the stigma of the same plant. Many plants do this as it increases the chances of successful reproduction, however, the offspring generated tend to show less genetic variation as only one parent was involved. Cross-pollination, where pollen lands on the stigma of a different plant, increases genetic variation in the next generation and this may be important for evolutionary change in a species.

**DIAGRAM 02:**



**Section 3: Plant Adaptations**

• How do plants prevent herbivores from eating them?

Plant tissues contain valuable nutrients for herbivores, including sugars and starches, proteins and fats. Many plants have evolved defensive strategies in order to deter herbivores and so protect their tissues. Many plants pack their tissues with toxic and foul tasting chemicals (some of which we use as drugs today), while others protect themselves with spines and thorns. Some plants mimic the defences of other species in order to deter herbivores, while others are so well camouflaged that many herbivores simply don't notice them!

• **Suggested Films**

- Defensive Plants
- FactPack: Power of Plants



Nettles use painful stings to keep enemies away

**Extension Question**

Q7. What is mimicry?

Some organisms have evolved to behave or look like other species, which often have well-developed defensive strategies. Hoverflies, for example, have stripes very like wasps even though they don't have a sting. Other organisms won't attack hoverflies for fear of being stung. White dead nettles don't sting either, but because they look very similar to common stinging nettles herbivores won't attempt to eat them.

### • How are plants adapted to extreme environments?

Like all living things, plants show adaptations to their environment. Their organs are often modified to allow them to survive and reproduce in a wide range of conditions. Desert plants, for example, often have deep roots to absorb water and swollen stems to store it. Their leaves are often covered in a thick, waxy cuticle to minimise transpiration and, in some cases, such as the cacti, they don't have leaves at all! This means they present much less surface area to the dry atmosphere of the desert and so lose far less water. Of course there is a downside in that photosynthesis is greatly reduced and so they grow very slowly.

#### • Suggested Film

– Plants in Extreme Environments

#### Extension Question

Q8. What is transpiration?

Transpiration is simply the evaporation of water from the leaves of a plant. Water vapour can pass out of the leaf through the stomata into the atmosphere. In dry habitats plants tend to show various adaptations to reduce this water loss. They may have smaller, fatter leaves to reduce surface area, less stomata and a thicker waxy cuticle.

### • What are invader plant species?



The kudzu vine is an example of an invader plant species; it has spread across southeastern America at an alarming rate

Species usually evolve within an ecosystem in response to both the physical environment around them and the other species that affect them in that ecosystem. That's why we see adaptations in the shape, colouration and defence mechanisms of plants. Unfortunately, if a new species is suddenly introduced into a habitat it can sometimes grow unchecked by natural predators and competitors. There are plenty of examples of man accidentally introducing a new plant species into a habitat with disastrous consequences. The introduction of the prickly pear to Australia is one such famous case.

#### • Suggested Film

– Invading Plant Species

#### Extension Question

Q9. How can invader plant species be controlled?

One way to control invader plants is to find a natural predator which can eat the troublesome species. When the prickly pear became a pest in Australia, covering vast areas of farmland, biologists introduced a caterpillar from South America which fed exclusively on the prickly pear. This example of biological control was extremely successful, though there have been cases where things have gone very wrong!



• Quizzes

Leaves

Basic

• What is the name of the chemical process involving sunlight that occurs in leaves?

- A – osmosis
- B – respiration
- C – photosynthesis
- D – transpiration

• What is the name of the organelle where photosynthesis takes place?

- A – the nucleus
- B – the chlorophyll
- C – the cytoplasm
- D – the chloroplast

• What is the name of the leaf pigment which absorbs sunlight?

- A – chlorophyll
- B – mesophyll
- C – epidermis
- D – stomata

• What are the small pores in the underside of a leaf called?

- A – guard cells
- B – epidermis
- C – stomata
- D – chloroplasts

Advanced

• What tissue of the leaf is covered in a waxy cuticle?

- A – spongy mesophyll
- B – palisade mesophyll
- C – epidermis
- D – stomata

• What are the cells called which surround the small pores in the underside of a leaf?

- A – guard cells
- B – epidermal cells
- C – stomata
- D – palisade cells

• What is the function of chloroplasts?

- A – respiration
- B – to control the activities of the cell
- C – protein production
- D – photosynthesis

• What do veins transport to the leaf?

- A – water and minerals
- B – carbon dioxide
- C – food
- D – oxygen

## Flowers

### Basic

• What is the function of flowers?

- A – respiration
- B – reproduction
- C – photosynthesis
- D – transpiration

• What are the male reproductive parts of a flower called?

- A – petals
- B – carpels
- C – ovaries
- D – stamens

• What is the scientific name for a plant egg?

- A – ovule
- B – anther
- C – filament
- D – ovary

• Once fertilised, what does the flower turn into?

- A – a seed
- B – a fruit
- C – a stamen
- D – an ovary

### Advanced

• What part of the stamen produces the pollen?

- A – ovule
- B – anther
- C – filament
- D – petal

• Pollination occurs when pollen lands on which part of the flower?

- A – ovule
- B – style
- C – filament
- D – stigma

• Which flower part links the stigma to the ovary?

- A – ovule
- B – style
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• Once fertilised, what do the ovules develop into?

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• Answers

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