Plant structure and function

Plant cells

Unlike animal cells, plant cells are surrounded by a cellulose cell wall. This helps to give each cell a definite shape. Also, plant cells usually have a large fluid filled vacuole, which allows them to be much larger than animal cells. Apart from this the cytoplasm is similar to that of animal cells, with a nucleus and many small specialised structures such as mitochondria. Mitochondria are the sites of respiration.

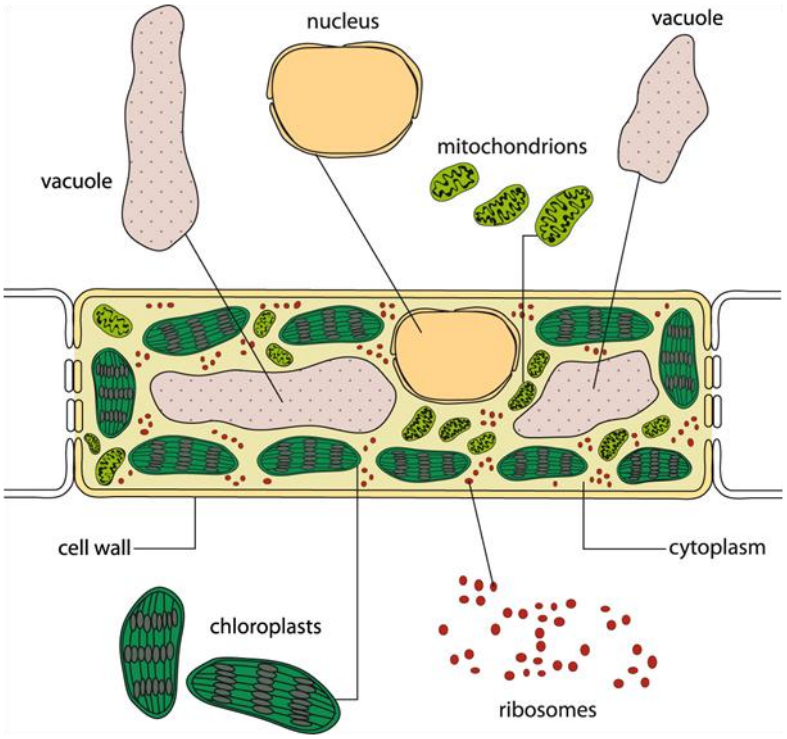

Figure Main structures found in a plant cell. The cell membrane (or plasma membrane) is pressed up against the cell wall.

Photosynthetic tissue

Cells which are able to carry out photosynthesis contain disc-shaped chloroplasts packed with chlorophyll. Starch grains may also be present.

Osmosis

If animal cells are placed into water or a dilute solution, excess water enters by osmosis and the cytoplasm of the cell swells, stretching and rupturing the cell membrane. The plant cell wall stretches slightly, but it resists the entry of excess water and prevents the cell from bursting. When a cell wall is slightly stretched it cell is firm or turgid. Turgid cells give tissues strength. If a plant loses water the cells lose their turgidity and the plant wilts.

Organelles

Electron microscopes have shown that cells contain many tiny structures each with specific functions to perform. As they have complex structures they are like tiny organs, and so are called organelles. Understanding cell structures and their functions and the chemical processes that take place allows scientists to select and manipulate the properties of plants and the products that can be obtained from them.

Tissues

Groups of similar specialised cells form tissues, for example:

- parenchyma - large thin walled packing cells that can be used for storage;
- palisade and spongy mesophyll - cells packed with chloroplasts for photosynthesis;
- xylem − long thin hollow cells with woody thickened walls used for transporting water and mineral ions in solution and helping to support the plant.

Photosynthesis and the transport of water containing minerals ions transport are key processes in the growth of healthy plants.

Structure and function

The main structures or 'organs' found in plants are the leaves, stems and roots. They are made up from groups of specialised tissues that have structures suited to the jobs they perform. The table below summarises the main features of these structures and their functions.

	Structure	Function
Leaves	• Thin with a large surface area. • Cells contain chlorophyll in chloroplasts.	• Short distances for gases to diffuse. Large area for absorption of light. • Leaves are a plant's food factory. They are the main site of photosynthesis, where sugars are made from water and carbon dioxide, using sunlight energy that has been absorbed by chlorophyll.
Stems	• Long and cylindrical. Woody tissues - xylem and fibres (sclerenchyma) - add strength. • Contain xylem and phloem (in 'veins').	• Support the leaves, flowers and fruit. Can bend or resist the wind. • Transport water, minerals to leaves and sugars to roots, flowers, fruit and roots.
Roots	• Branch extensively through the soil. • Root hairs - provide huge surface area. • Contain xylem and phloem (in 'veins'). • Root tip - area of cell division. • Root cap - covers the root tip.	• Provide anchorage in the soil. • Enable absorption of water and nutrients. • Enable transport of water and nutrients. • Grow into the soil. • Protects and lubricates the growing root.

Finding out

Plants are able to make a wide variety of molecules, but they are not always suitable to meet human needs and demands. There is huge pressure to meet expanding human energy requirements and the use of biomass as a source of renewable fuel has been widely investigated by scientists. Chemists and biotechnologists are using new technologies, including nanotechnology, to increase the usefulness of renewable materials obtained from plants.

What is nanotechnology?

What are plant secondary metabolites and how are they enabling scientists to make advances in, for example, medicines or food?

Why is the research described in RSC's *Chemistry World*[1] important?

Note: The article contains technical language that students are likely to find difficult. Guidance may be needed to help them to pick out the important facts. Further research may be necessary to understand it fully.

[1] http://www.rsc.org/chemistryworld/News/2010/December/21121002.asp