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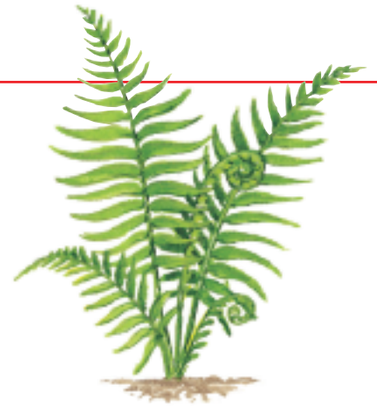
PLANTS

THE SECOND LARGEST kingdom of living things after animals is the plants. The key feature of a plant which sets it apart from other living things is that it obtains energy from light by the process of photosynthesis *(see page 12)*. Most plants have broad, flat surfaces, such as leaves or fronds, where this happens. Just as there are many groups of animals, from simple worms to complicated mammals, so there are many groups of plants. However they are divided into two main kinds—the simpler types without flowers, and those with flowers.

The tiny plants that drift in the ocean, phytoplankton, are a mix of protists and small algae. They are food for tiny animals, zooplankton.

Some seaweeds grow to enormous sizes. Giant kelps have fronds more than 60 metres long and in good conditions they can grow more than one metre each day. Like trees on land, they are food and shelter for many animals.



Ferns can survive on low levels of light. Many types grow in woodlands in the shade under large trees.

NON-FLOWERING PLANTS

The simplest non-flowering plants are **algae.** They nearly all live in water, although a few kinds can survive in damp places, like *Pleurococcus* alga which grows as a green powder on shady tree trunks. Nearly all seaweeds and some types of pondweeds, such as the green, hair-like spirogyra, are algae. An alga has no proper roots, stem or leaves, although it may have a stem-like part and leaf-like blade. It absorbs water and nutrients through its body surface.

Mosses and **liverworts** are known as bryophytes. A moss has small green leaflets but no proper stem or roots. It absorbs water and nutrients through its leaflets so it can only live in damp places. Liverworts grow in similar places. Each has a low, flattened body known as a thallus.

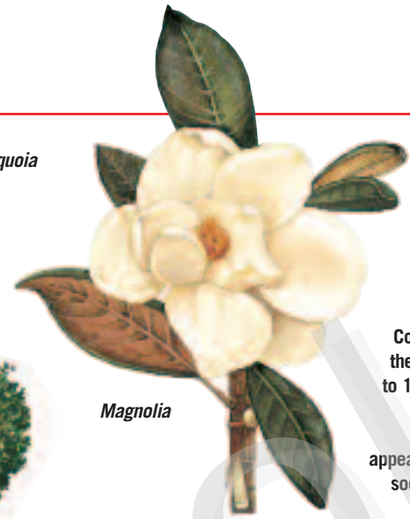
Ferns, or pteridophytes, are also non-flowering. A fern has roots which absorb water and minerals from the soil, and a stiff stem to hold up its much-branched fronds. The stem, like the stem of a flowering plant, contains tiny pipes or tube-like vessels to carry the water and other substances from the roots to the fronds. Plants with these vessels are known as vascular plants.

All of these non-flowering plants reproduce by making tiny, dust-like spores which grow into new plants. **Conifers,** also called gymnosperms, reproduce by seeds. The seeds form in hard, scaly structures known as cones. Pines, firs, spruces, larches, redwoods and cypresses are all conifers.

Giant sequoia

All conifers, or cone-bearing plants, are bushes or trees. Most have long, narrow leaves that do not fall off in autumn and so are known as evergreens. The biggest living things on Earth, giant sequoias weighing over 2000 tonnes, are conifers.

Palms grow in dry, tropical lands. A date palm can grow up to 30 m high and live for 200 years.



Magnolia

The first plants to evolve on Earth were probably small, simple seaweeds or algae. The first land plants grew some 400 million years ago. Conifer trees dominated the land from about 200 to 120 million years ago. Then the first flowers, similar to magnolias, appeared. Flowering plants soon took over the land.

FLOWERING PLANTS

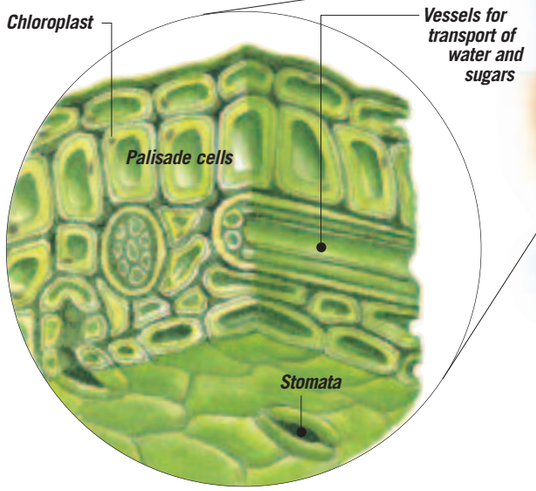
The flowers of flowering plants, also known as angiosperms, are body parts specialized for breeding. The flowers produce seeds which in suitable conditions grow into new plants, as shown on the following pages. Flowering plants are by far the main or dominant group of plants around the world, except for seaweeds in the oceans and the conifer forests in colder regions. Flowering plants include familiar herbs, grasses, reeds, rushes, wild and garden flowers, and most trees and bushes (except for the conifers). There are some 260,000 different kinds or species of flowering plants compared to about 550 species of conifers, 11,000 ferns, 23,000 mosses and liverworts, and around 12,000 species of algae.

Crocus *Buttercup*

The two main kinds of flowering plants are named from the number of cotyledons. These are nutrient-packed "seed leaves" that provide food for the baby plant as it grows from a seed. Monocots have one cotyledon and include palms, grasses and some flowers such as lilies, crocuses and orchids. Dicots have two cotyledons and include all other kinds of flowers, bushes and trees.

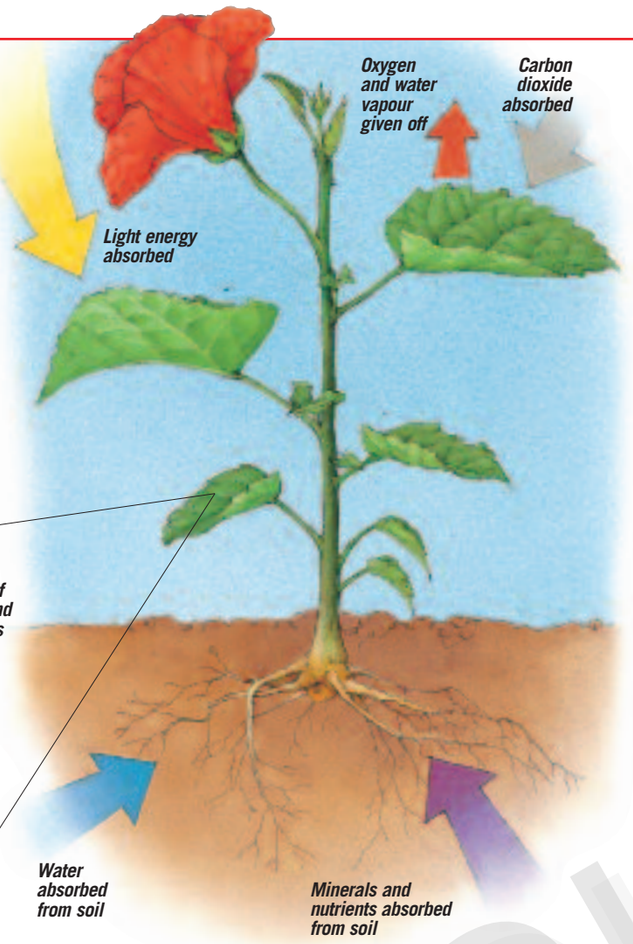
How Plants Live

A PLANT may not look lively and active. But inside its millions of microscopic cells, thousands of chemical changes take place as part of the plant's life processes. Like an animal's body, a plant's body has many specialized parts for different jobs. The roots take in water, minerals, salts and other substances from the soil in which the plant grows. The stiff stem holds the main parts of the plant above the surface, away from animals on the ground that might eat it, and above other plants so that the leaves can catch more sunlight.



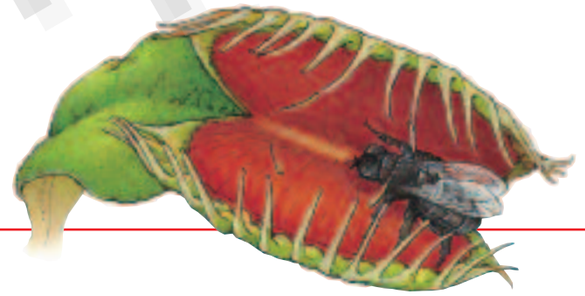
The tall palisade cells in the leaf's upper surface have many tiny blobs or discs called chloroplasts. These contain the chlorophyll which carries out photosynthesis.

A plant's leaves are "light-powered food factories". They are broad and flat so that as much light as possible falls on them. A green substance called chlorophyll in the leaves catches or absorbs the energy in light. It uses this energy to make a chemical reaction. Water, taken up from the soil, and carbon dioxide, taken in from the air, join together to form sugar, which contains lots of energy in chemical form. The plant then uses the sugar to power its life activities. The process is called **photosynthesis**—a word meaning "making with light".



The carbon dioxide for photosynthesis comes from the air. It seeps into the leaf through tiny holes in its lower surface, known as stomata. In addition to sugar, photosynthesis also produces oxygen, which seeps out into the air. Living things including ourselves need oxygen to survive. Plants help to top up its level in the air.

The venus fly-trap lives in poor soil with few minerals and nutrients. It catches small animals, dissolves them and takes in their juices as an extra nutrient supply.

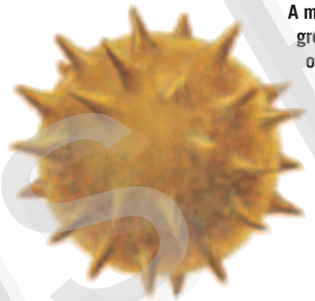


Flowers and Pollen

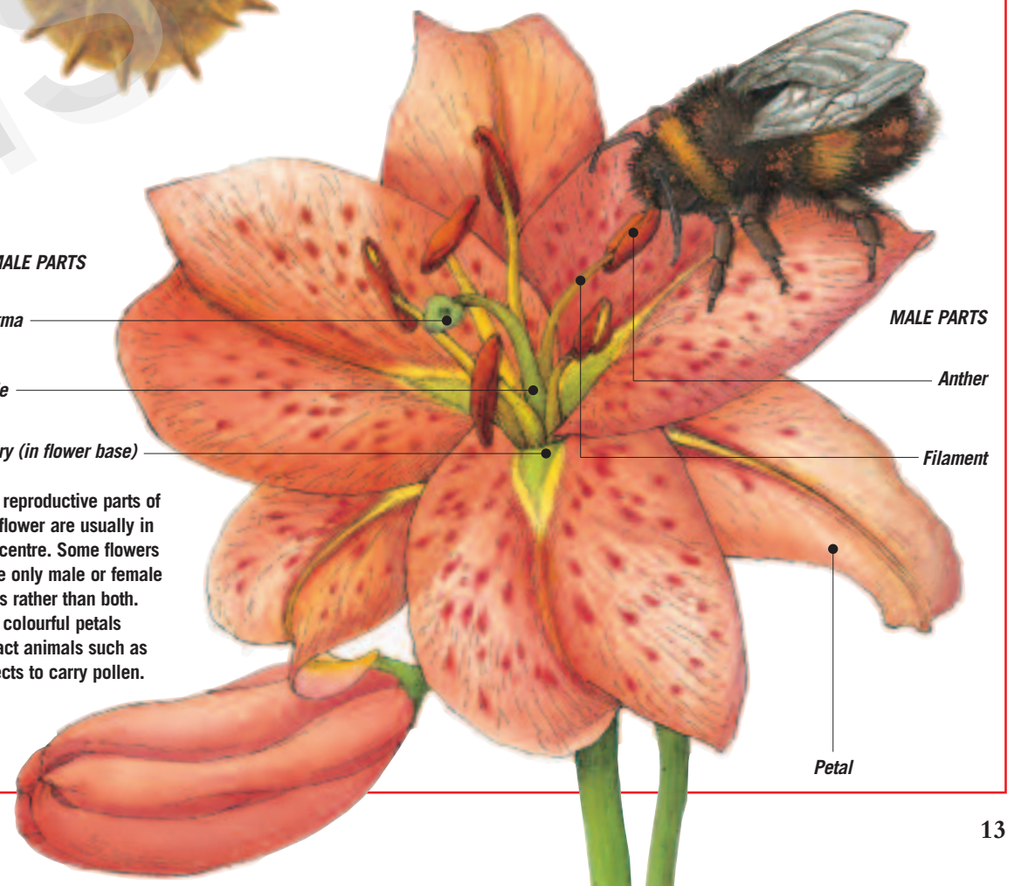
A plant's flower is designed to reproduce—make seeds which grow into new plants. A typical flowering plant has both male and female parts. The male parts make tiny particles, pollen grains, which look like fine yellow powder. Each grain contains a male cell. Pollen is produced in bag-like anthers on stalks, called filaments. The female cells or ovules (eggs) are in the ovary, a fleshy part at the flower's base. A taller part, called the style, sticks up from this, with the stigma at its top. Pollen must travel from the anthers of one flower to the stigma of another of the same kind, so the male and female cells can join and develop into seeds.

Many different kinds of animals help to pollinate flowers. They include birds, insects and various kinds of mammal. Like others, the honey possum comes to drink the flower's sweet nectar or "honey".

The transfer of pollen is called pollination. Some pollen grains are light and balloon-like and are blown by the wind. Others are sticky and carried by animals. To attract animals, the flower has colourful petals and a strong scent and makes a sugary liquid called nectar. When animals come to drink the nectar, the pollen sticks on them. It brushes off at the next flower on to the stigma. A tube grows from the pollen grain down the style to the ovary. The male cell moves down this to join the ovule.



A microscope shows grooves, spikes and other structures on a pollen grain. Each kind of plant has its own pollen grain pattern.



The reproductive parts of the flower are usually in the centre. Some flowers have only male or female parts rather than both. The colourful petals attract animals such as insects to carry pollen.