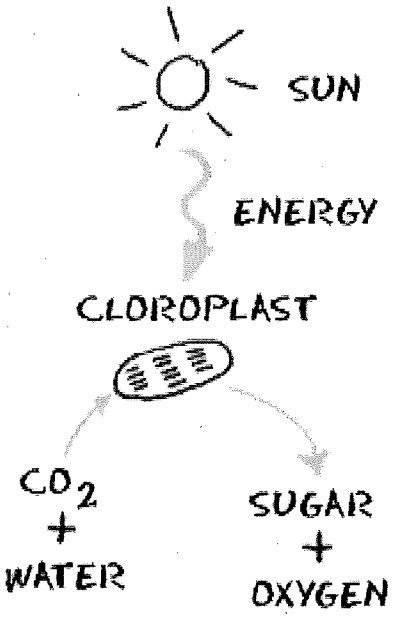
PHOTOSYNTHESIS -
PART I: THE SUN AND LIGHT

Not all of the light from the **Sun** makes it to the surface of the Earth. Even the light that does make it here is reflected and spread out. The little light that does make it here is enough for the plants of the world to survive and go through the process of **photosynthesis**. Light is actually energy, electromagnetic energy to be exact. When that energy gets to a green plant, all sorts of reactions can take place to store energy in the form of sugar molecules.



Remember we said that not all the energy from the Sun makes it to plants? Even when light gets to a plant, the plant doesn't use all of it. It actually uses only certain colors to make photosynthesis happen. Plants mostly absorb **red** and **blue** wavelengths. When you see a color, it is actually a color that the object does NOT absorb. In the case of green plants, they do not absorb light from the green range.

PART II: THE CHLOROPLAST

We already spoke about the structure of **chloroplasts** in the cells tutorials. We want to reinforce that photosynthesis happens in the chloroplast. Within this cell **organelle** is the chlorophyll that captures the light from the Sun. We'll talk about it in a bit, but the chloroplasts are working night and day with different jobs. The molecules are moved and converted in the area called the **stroma**.

PART III: THE MOLECULES

Chlorophyll is the magic compound that can grab that sunlight and start the whole process. Chlorophyll is actually quite a varied compound. There are four (4) types: a, b, c, and d. Chlorophyll can also be found in many microorganisms and even some prokaryotic cells. However, as far as plants are concerned, the chlorophyll is found in the chloroplasts. The other big molecules are water (H_2O), carbon dioxide (CO_2), oxygen (O_2) and glucose ($C_6H_{12}O_6$). Carbon dioxide and water combine with light to create oxygen and glucose. That glucose is used in various forms by every creature on the planet. Animal cells require oxygen to survive. Animal cells need an aerobic environment (one with oxygen).

PART IV: LIGHT AND DARK REACTIONS

The whole process doesn't happen all at one time. The process of photosynthesis is divided into two main parts. The first part is called the **light dependent reaction**. This reaction happens when the light energy is captured and pushed into a chemical called ATP. The second part of the process happens when the ATP is used to make glucose (the **Calvin Cycle**). That second part is called the **light independent reaction**.

A GENERAL PLANT STRUCTURE

We're going to look at plant structure in this section. The plants we discuss will be vascular plants that have systems of tubes (xylem and phloem) for the transport of nutrients and water. Remember that there is a wide variety of plants on Earth and even a whole group that doesn't have **vascular systems**. Mosses and liverworts may still have photosynthesis, but they do not have that 'classic' plant structure. Then you will find species such as cacti that don't have leaves. They conduct **photosynthesis** in their stems. Anyway, just remember that there are many other possibilities in the plant kingdom.

ALTHOUGH MANY PLANTS HAVE LEAVES, PHOTOSYNTHESIS HAPPENS IN MANY PLACES.

ALIKE BUT DIFFERENT

We just told you about the many exceptions to the basic plant structure, so let's look at some similarities. An easy similarity is on a cellular level. Plants conduct photosynthesis. This process of converting the Sun's energy into molecular energy happens in chloroplasts with the help of chlorophyll molecules and a variety of enzymes. Vascular plants share a similar set of structures called roots, stems, and leaves. Many plants have specialized versions, but the basics are there. One specialization might be the petals of a flower. Those flower petals are specialized leaves that surround the reproductive structures of the plant.

THE ROOTS BELOW GROUND

We'll start at the bottom with the **roots**. These structures are designed to pull water and minerals from whatever material the plant sits on. For water plants, the roots may be in the water. For traditional trees, the roots go deep into the soil. There are even plants called epiphytes that live in trees and their root system clings to branches. Humans often capitalize on the roots of plants for food. Carrots are just one big orange root.

Root systems also provide support for plants in the form of an anchor in the soil. If the wind blows hard, those roots keep the plant from falling over. Some plant species have roots above ground that provide support for the entire plant. Roots are further broken down into the primary root and lateral roots that each has **apical meristem** at their tips. **Root hairs** are also a common structure on roots. They make the roots look fuzzy and help in the absorption of water and nutrients.

SHOOTS ABOVE GROUND

Sure we said that there are some roots above the surface, but the majority of the plant you see is made up of **stems** and **leaves**. Think about a tree. The stems are the trunks and branches. Leaves are self-explanatory. Stems are all about transporting food and water and acting as support structures. Leaves are all about photosynthesis, creating food molecules and absorbing carbon dioxide for the plant. These parts are connected by the vascular system of xylem and phloem that spreads through the entire plant.

The tip (**terminal bud**) of the main stem has a specialized structure that is the source of new growth for plants. You will find the apical meristem that develops into young leaves (**primodium**). There are other points of growth at each **node** where leaves and branches develop on the stems. Those branching points are home to **axillary buds** that can also develop into new branches.