ILLUSTRATED

GUIDE BOOK

4D MASTER®

4D SCIENCE™ MODEL

PLANT CELL

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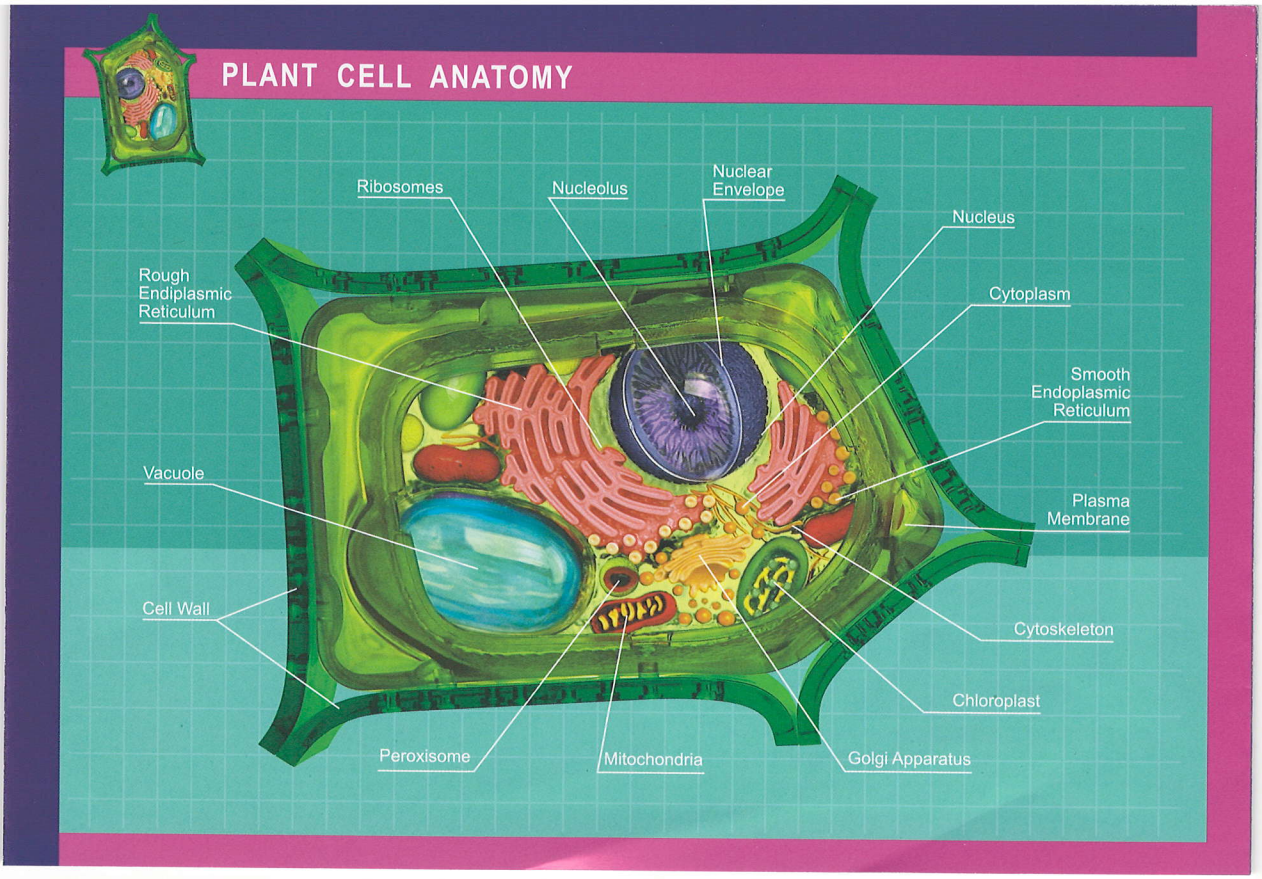
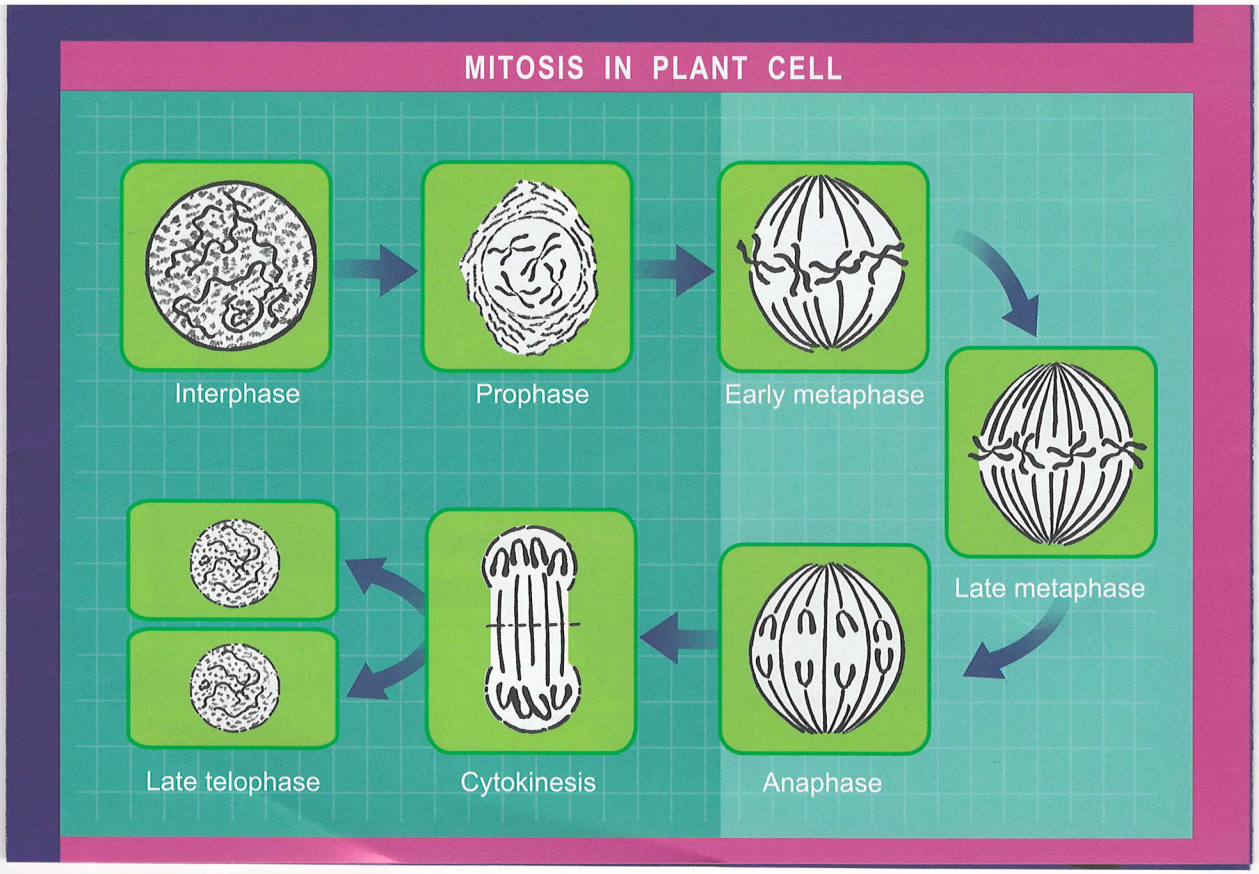

PLANT CELL ANATOMY
Ribosomes
Nucleolus
Nuclear Envelope
Nucleus
Rough Endiplasmic Reticulum
Cytoplasm
Smooth Endoplasmic Reticulum
Vacuole
Plasma Membrane
Cell Wall
Cytoskeleton
Chloroplast
Peroxisome
Mitochondria
Golgi Apparatus


MITOSIS IN PLANT CELL
Interphase
Prophase
Early metaphase
Late metaphase
Anaphase
Cytokinesis
Late telophase

NUCLEUS

The nucleus is the most obvious organelle in most of eukaryotic cells, which is enclosed in a double membrane and contains most of the cell's genetic material, organized as multiple long linear DNA molecules in complex with a large variety of proteins, such as histones, to form chromosomes.

PEROXISOME

It is membrane-bound packet of oxidative enzymes. In plant cells, they have functions of converting fatty acids to sugar and assisting chloroplasts in photorespiration. Peroxisomes also help to break down the hydrogen peroxide into water and oxygen.

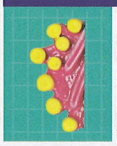
CELL WALL

Plant cells have rigid outermost boundary (cell wall) of polysaccharides, mainly as a mechanical supporter. Unlike plasma membranes, materials cannot get through cell walls, but it has some special openings (plasmodesmata) on the surface. Plant cell also has the plasma membrane as selective boundary too. The cell wall in a young cell is much thinner and not very rigid, which allows the young cell to grow.

MITOCHONDRIA

It is a bacteria sized power generator; it provides the energy needed for a cell to move, to divide, to produce secretory products. They may have different shapes depending on the cell type. Scientist found that mitochondria also contain DNA too; we called it Mitochondrial DNA (mtDNA).

SMOOTH ENDOPLASMIC RETICULUM

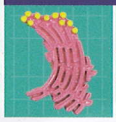


Endoplasmic reticulum (ER) is a vast network of membrane-bound vesicles and tubules responsible for the production of hormones and other secretory products. The smooth ER has different functions depending on the specific cell type.

RIBOSOMES

They are packets of RNA and protein. As an essential role in both prokaryotic and eukaryotic cells, it assembles individual amino acids into polypeptide chains of proteins. This process is called “translation”.

ROUGH ENDOPLASMIC RETICULUM



It appears "pebbled" due to numerous ribosomes on its surface. Proteins synthesized on these ribosomes are collect in the endoplasmic reticulum for transport throughout the cell.

CYTOSKELETON

It is the skeleton contained within the cytoplasm, which helps to maintain cell shape. Actually, the internal movement of cell organelles, such like cell locomotion and muscle fiber contraction could not function without the cytoskeleton. The cytoskeleton consists of three primary protein filaments (microtubules, microfilament and intermediate fibers).

GOLGI COMPLEX

Also called Golgi apparatus, Golgi body or dictyosome. This important apparatus has the function to manufacture and package the macromolecules such as proteins and lipids that are synthesized by the cell. The Golgi complex plays as a part of the endomembrane system of eukaryotic cells, which regulates protein traffic and performs metabolic functions.

SECRETORY VESICLES

They are membrane-bound vesicles derived from the Golgi complex and contain material (e.g. hormones, neurotransmitters.) that is to be released from the cell, and then transported to the cell surface for release.

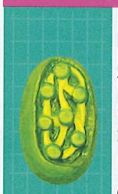
CYTOPLASM

It is a semi-transparent jellylike fluid that fills most cells, and consists of three major elements; the cytosol, organelles and inclusions. The cytosol is the "soup" inside all the cells.

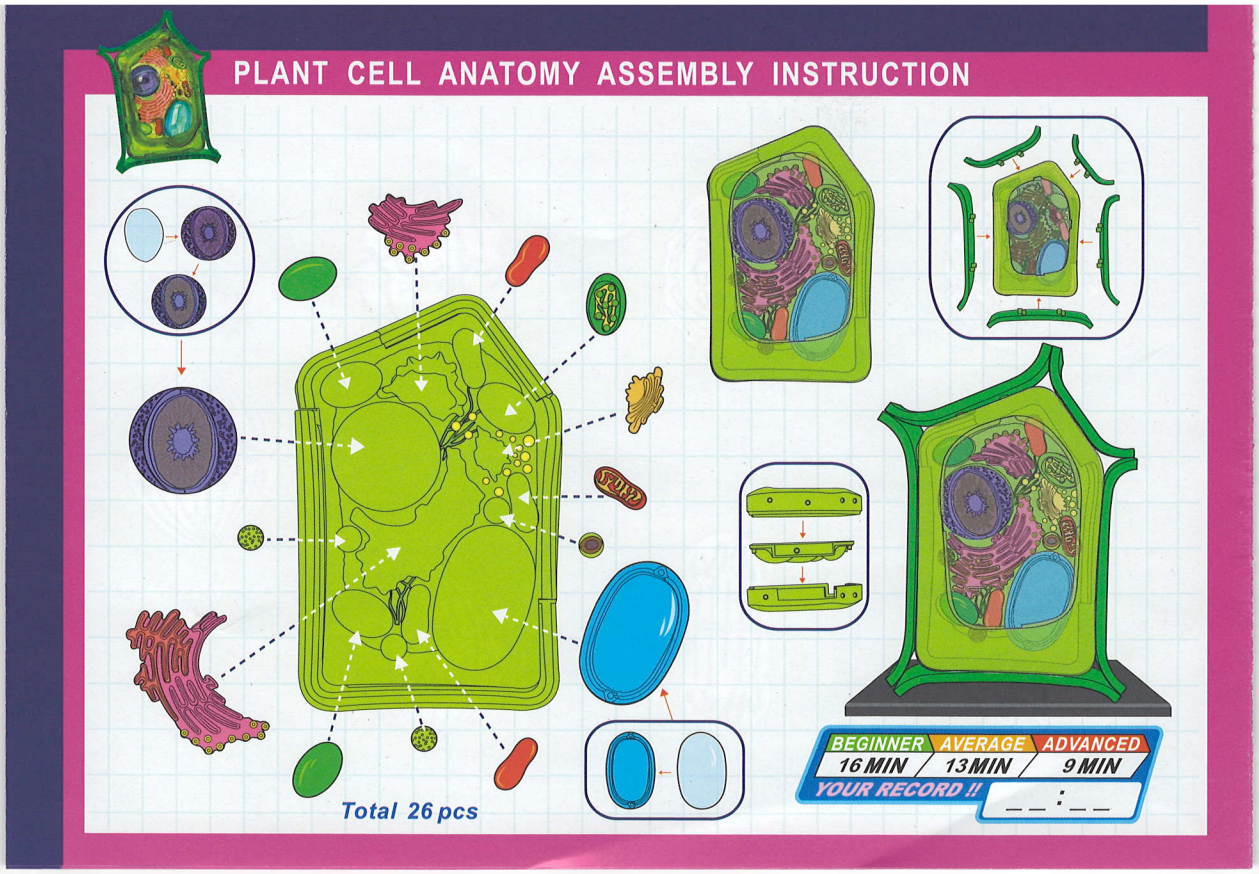
VACUOLE

It is a big membrane-bound sac that helps intracellular digestion, storing nutrients and releasing cellular waste. Sometimes, vacuole may occupy 90% volume of a plant cell. Young plant cells often contain many small vacuoles. Water collected in cell vacuoles would press outward against the cell wall and produce rigidity in the plant. Without sufficient water, turgor pressure drops and the plant wilts.

CHLOROPLAST

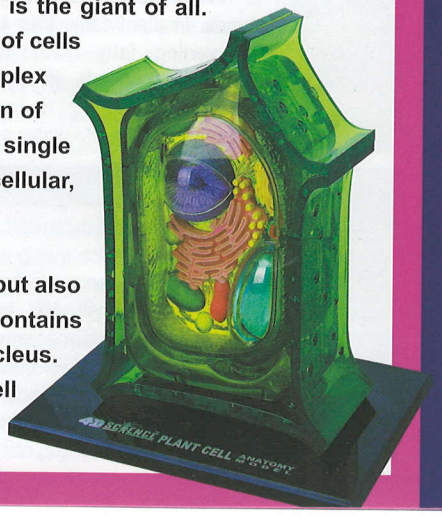


It is specialized organelles found in all higher plant cells, which harvest energy from sunlight to complete the chemical reaction [6 CO_2 (carbon dioxide) + 6 H_2O (water) + Sunlight >> $C_6H_{12}O_6$ (glucose) + 6 O_2 (oxygen)]. Plant cells manufacture glucose and other carbohydrates that they can store for later use. This process called “photosynthesis”.


PLANT CELL ANATOMY ASSEMBLY INSTRUCTION
Total 26 pcs
BEGINNER
16 MIN
AVERAGE
13 MIN
ADVANCED
9 MIN
YOUR RECORD !!
_ _ : _ _

The word cell comes from the Latin cellula, which means a small room. Robert Hooke was the first to study and record cells by using a microscope. The descriptive name “CELL” for the smallest living biological structure was also given by him, and used in his book that published in 1665. In 1837, a Czech Jan Evangelista Purkyňe first observed small "granules" at the plant tissue through a microscope. The cell theory was first developed in 1839 by Matthias Jakob Schleiden and Theodor Schwann. The cell is a basic functional part and the smallest living unit in all known living organisms. Most of the living cells are very small in size, and measured in unit of μm, and weight in nanogram. However, the eggs are the biggest single cell in most of organisms. As we known, ostrich egg is the giant of all.

One single animal and plant may consists of a great number of cells in different types, which called multicellular. Some complex organisms, such as a human adult, may have over 100 trillion of cells. On the other hand, some organisms only consist of a single cell, such as bacteria and ameba, which are called unicellular, protist or monad.



The Plant Cell is not only enclosed in a thin cell membrane, but also protected by a rigid protective cell wall. This small room contains many different organelles including a membrane-bound nucleus. All higher plant cells have chloroplast. Only plant cell have cell wall and chloroplast, animal cells do not have any.

4D Q & A

GUESS WHAT ?

Q: Why most of the leaves of plants are in green colour?

A: That is because the plant cells in leaves containing chloroplast which is for the process of photosynthesis, and the pigment of chloroplasts in a mature healthy leaf is green.

Q: Why most of the leaves in plants will turn red or drown during the fall?

A: When the chlorophylls break down during the fall, the other colors become apparent. Anthocyanin and Betacyanins in plants are the common reason that cause the leaves turn red or drown during the fall.

Q: What drive a cell to divide?

A: The simple answer is “genes”! The DNA inside the nucleus of original and paternal cell, is the "blueprint" that how to build an organism. Genetic material prompt drive the cell to divide into two cells, then two cells divide to make four.....and so on and on.

Q: Do all the plant cells look the same?

A: No, there are many different kinds of plant cells, in different shapes and functions. Even in a same plant, their cells won’t be the same in different parts of the plant.

Q: Why we always see a big empty space in the middle of a plant cell under the microscope?

A: Don't be fooled, that is the vacuole which contains large amounts of water and stores other important materials such as sugars, ions and pigments.

Q: Why most of the plants do not need any food for their supply?

A: That is because; most of the plant can produce food by themselves during the photosynthesis. They convert light energy into chemical energy. The raw materials include carbon dioxide and water; the energy source is sunlight; and the end-products are oxygen and (energy rich) carbohydrates. That is the main energy source of the whole ecosystem on earth.