

DİŞ HEKİMLİĞİ
1.SINIF BIOPYSHICS
SLAYTLARI
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Introduction to Cell

Cells form the basis of all living things .

The Cell Theory

- A cell is the smallest unit of life
- Cells come from existing cells
- All living organisms are composed of cells

Multicellular

Unicellular

there are two key types of cells i.e. the Prokaryotic Cell and the Eukaryotic Cell. The difference between the two is defined mainly by the presence or the absence of the nuclear membrane

1

2

The **cell** is the basic functional and structural unit of life. All the living organisms are composed of **cells**. All **cells** are formed by the division of the already existing **cells** which in terms of biology means reproduction. Every **cell** of our body comprises of genetic material which is passed down during the process.

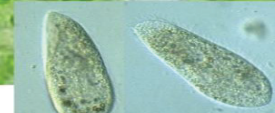
The cell is the smallest structural unit of a living organism. So, everything that we are able to do is possible because of the 10 trillion cells present in our body. The number is huge and of course, the function performed by them is even bigger. In this topic here, we'll introduce you to cells

Prokaryotic Cell

If a cell has a nuclear material without a nuclear membrane, then it is known as the prokaryotic cell. Those organisms which have these type of cells are commonly known as the prokaryotes where 'pro' stands for primitive and 'karyon' stands for the nucleus. Some of the organisms that have prokaryotic cells include bacteria and the blue-green algae.

Unicellular organisms

- Bacteria (prokaryotes)
- Archaea (prokaryotes)
- Protozoa (eukaryotes)
- Some algae (eukaryotes)
- Some fungi (eukaryotes)
- Perform all functions of life!



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Connections to other Topics



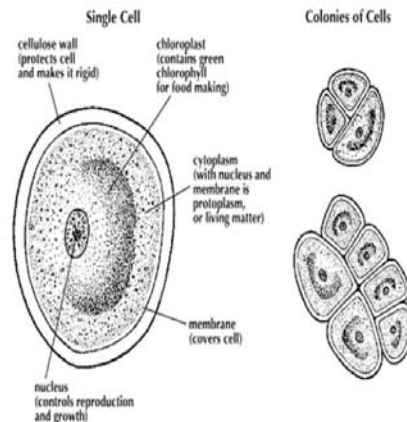
UNICELLULAR ORGANISMS

• Some organisms are composed of only one cell.

- eg: *Paramecium*, *Chlamydomonas*, *Euglena*, *Chlorella*, *Amoeba*

• This single cell has to carry out all the activities essential to living organisms.

- ie: obtaining food, excreting waste products, producing offspring



Eukaryotic Cell

If a cell has a nuclear material with a nuclear membrane, then it is known as the [Eukaryotic Cell](#). Those organisms which have these type of cells are commonly known as eukaryotes where 'eu' stands for true and 'karyon' stands for the nucleus.

Cell is the basic structural and functional unit of life and all the organisms are made up of cells. The subcellular structures of the cell comprise of the plasma membrane, organelles and in some cases a nucleus as well.

[human](#)

- ♦ Contain all ~25,000 genes
- ♦ Only express the few it needs
- ♦ Differentiation = turning some genes on some off

Unicellular organisms perform ALL THE FUNCTIONS OF LIFE!

■ Nutrition

- ♦ Obtain molecules needed for ATP production
- ♦ Glucose, O_2 , CO_2

■ Excretion

- ♦ Rid of waste

■ Metabolism

- ♦ ATP production
- ♦ Synthesis of proteins, carbohydrates, fats, nucleic acids

■ Response

- ♦ React to stimuli

■ Homeostasis

- ♦ Maintaining a constant internal environment

■ Growth



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A cell is capable of independent existence and can carry out all the functions which are necessary for the existence of the living being. Some of the functions that are performed by the cell include [nutrition](#), respiration, excretion, transportation and reproduction.

These functions are very similar to the functions of the individual organism. Even the unicellular organisms are capable of independent existence. This proves the capability of the cell to exist independently. Therefore, a cell is the structural and fundamental unit of life.

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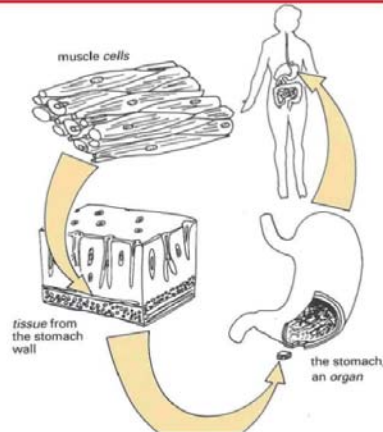
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Recall – 1.1 U4 Multicellular organisms have properties that emerge from the interaction of their cellular components.

Interaction between different cells to create new functions

Allows multicellular organisms to complete functions that individual cells cannot

E.g. Cell → Tissue → Organ → System



1.1 U5 - Specialized tissues can develop by cell differentiation in multicellular organisms

MULTICELLULAR ORGANISMS

• Multicellular organisms consist of many cells.

• These cells do not have to carry out many different functions.

• Instead they can become specialised for one particular function and carry it out very efficiently.

• This is called **differentiation**.

• eg: muscle cell, nerve cell, xylem cell

• Each cell has all the genes for the organism BUT only certain genes are turned on, the ones needed for that cell's particular function. The others are switched off because the cell does not do that function.

→ Gene expression

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IV. Cell Diversity

A. Shape

1. different shapes because they have different functions
 - a. nerve cells – long extensions to receive and give message
 - b. flat skin cells – to protect
 - c. white blood cells change shape so they can move through narrow openings

B. Internal organization

1. Eukaryotic Cells

nucleus

membrane bound organelles

Ex: plants, animals, fungi, protists

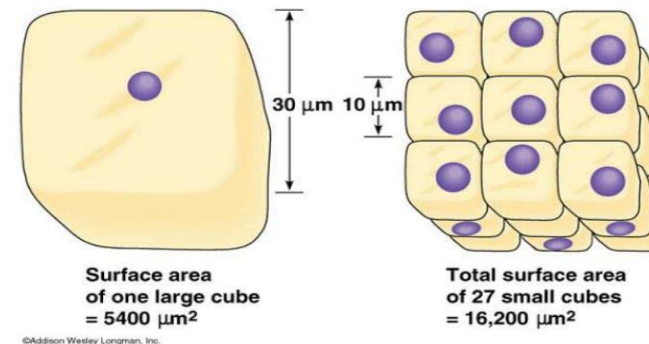
2. Prokaryotic Cells

no nucleus

no membrane bound organelles

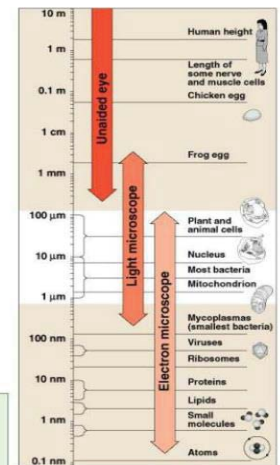
Ex: Bacteria

C. Size: there is a limit of size due to the speed at which material need to get to the center of the cell



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MEASUREMENT EQUIVALENTS	
1 centimeter (cm) = 10^{-2} meter (m) =	
1/100 m = about 0.4 inch	
1 millimeter (mm) = 10^{-3} m =	
1/1000 m = 1/10 cm	
1 micrometer (μm) = 10^{-6} m =	
1/1,000,000 m = 1/10,000 cm	
1 nanometer (nm) = 10^{-9} m =	
1/1,000,000,000 m = 1/10,000,000 cm	
1 meter = 10^2 cm = 10^3 mm =	
10^6 μm = 10^9 nm	



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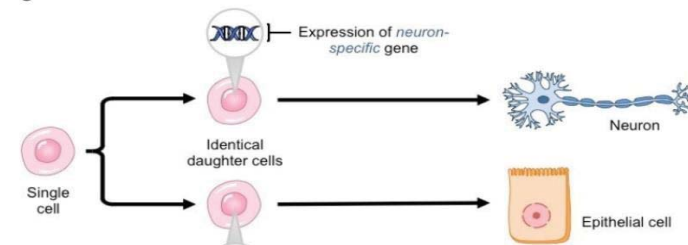
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D. Difference between plant and animal cells: Remember, they're BOTH Eukaryotic!

Plant cell	Animal cell
Thick rigid cell wall	<u>No cell wall</u>
Rectangular shape	No rigid shape (<u>roundish</u>)
Has chloroplasts	<u>No chloroplasts</u>
Large central vacuole	<u>Some have small vacuoles</u>

1.1 U5 - Specialized tissues can develop by cell differentiation in multicellular organisms

- Differentiation is the process during development whereby newly formed cells become more specialized and distinct from one another as they mature
- All cells of an organism share an identical genome – each cell contains the entire set of genetic instructions for that organism
- The activation of different instructions (genes) within a given cell by chemical signals will cause it to differentiate



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Cell Theory

- The cell is the basic functional and structural unit of life.
- All the living organisms are composed of cells.

• All cells are formed by the division of the already existing cells which in terms of biology means reproduction. Every cell of our body comprises of genetic material which is passed down during the process.

• All the basic physiological and chemical functions i.e. the growth, repair, movement, communication, immunity and digestions are performed inside the cells.

• All the activities of the cell depend mainly on the activities of the subcellular structures that lie within the cell. These subcellular structures comprise of the plasma membrane, organelles and if present, the nucleus.

1.1 U5 - Specialized tissues can develop by cell differentiation in multicellular organisms

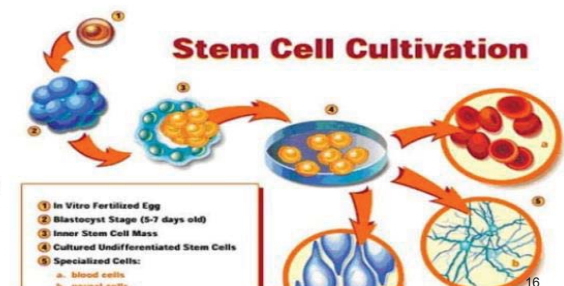
STEM CELLS

- Unspecialised and undifferentiated cells with 2 key qualities

1. **Self renewal** → Can divide and replicate

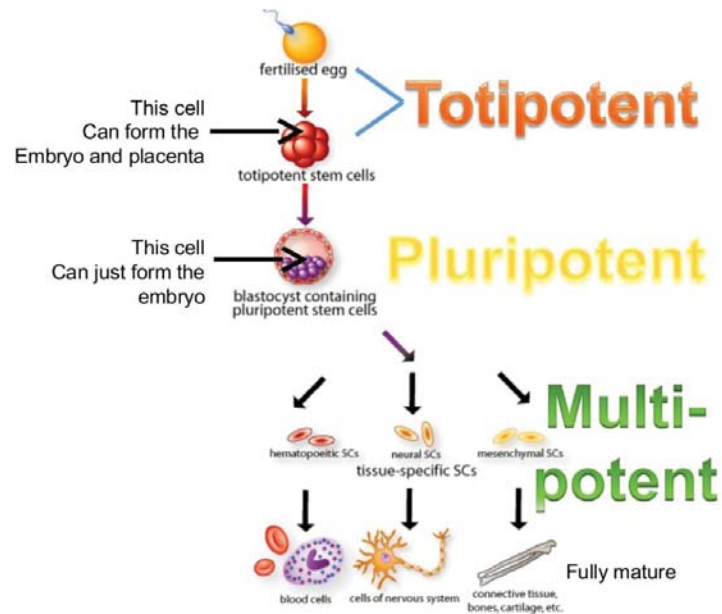
2. **Potency** → Capable of differentiation

- Derived from embryos or from the placenta/umbilical cord



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Stem Cells retain the **capacity to divide** and can **differentiate** along divergent pathways.

Totipotent

Can differentiate into any type of cell.

Pluripotent

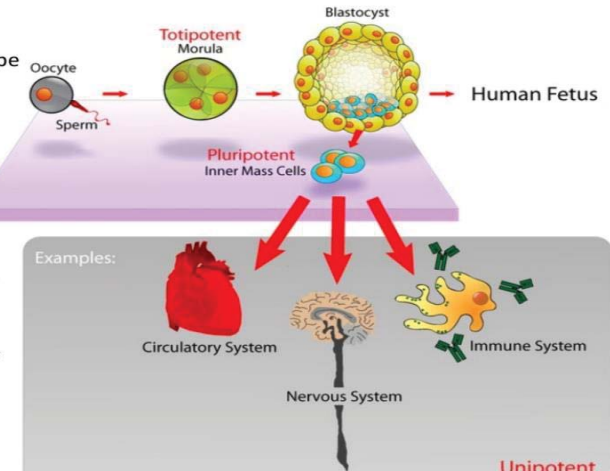
Can differentiate into many types of cell.

Multipotent

Can differentiate into a few closely-related types of cell.

Unipotent

Can regenerate but can only differentiate into their associated cell type (e.g. liver stem cells can only make liver cells).



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A. The cell is the smallest unit that can carry on all processes of life.

1. make energy
2. produce waste
3. reproduce
4. respond to stimulus
5. grow

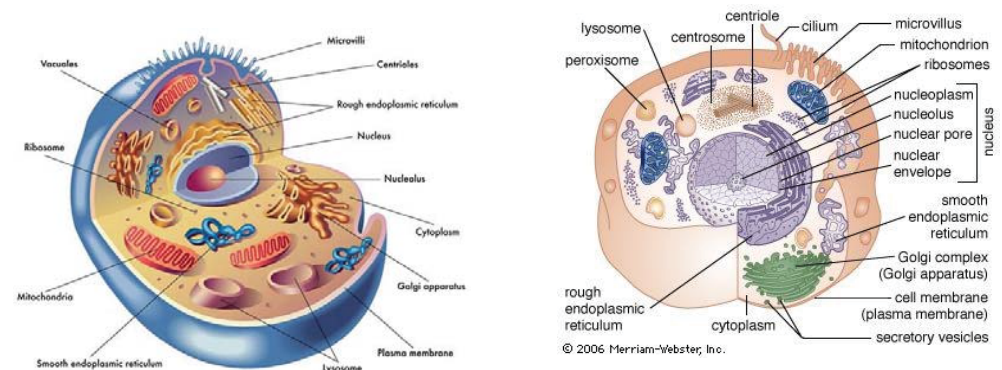
B. Unicellular: one celled organisms... Protists and Bacteria

C. Multicellular: more than one celled organisms...

D. Discovery of the cell was made possible by the development of glass lenses.

1. Leeuwenhoek (Dutch)- first person to observe living cells
2. Hooke (English)- observed cork from the bark of an oak tree.

a. The cells looked like empty compartments similar to cells in a monastery so he named them "cells"



Firstly, that main jelly like fluid is made up of something called cytosol and is actually known as '**cytoplasm**'. This cytoplasm is meanwhile held together partly by a series of long fibres collectively called the '**cytoskeleton**'. This structure determines the shape of the cell, aids cell division (mitosis) and helps transport other compounds within the cell. The **cell membrane** surrounds the whole thing and keeps it from spilling out everywhere (it is also sometimes called the phospholipid bilayer membrane).

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The **nucleus** is that all important blob in the centre of the cell which contains the **chromosomes**. Chromosomes are highly important because they hold the DNA – genetic code – that determines how every cell should behave within the body. A '**nuclear envelope**' surrounds the nucleus and works in a similar fashion to the cell membrane.

Mitochondria, are 'organelles' that can convert the energy from food into a useable form for the cells. They actually have their own genetic material that's distinct from the DNA and can replicate in a similar way to the cells at large.

Ribosomes are also organelles like the mitochondria, except they have the different job of creating proteins. They also float freely within the cytoplasm

The Golgi complex, stacks of flattened sacs, processes and packages materials to be released from the cell in secretory vesicles.

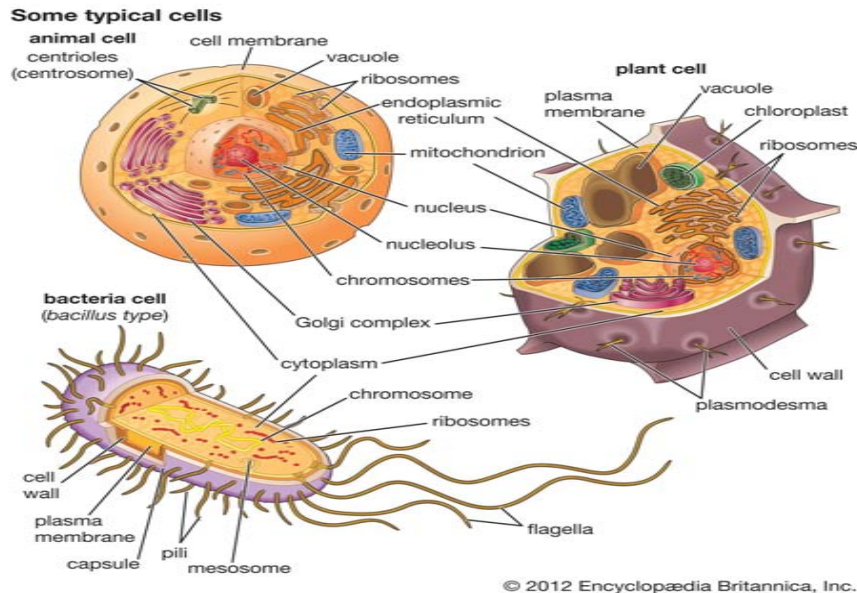
Digestive enzymes are contained in **lysosomes**. **Peroxisomes** contain enzymes that detoxify dangerous substances. The centrosome contains the centrioles, which play a role in cell division. The microvilli are fingerlike extensions found on certain cells.

Cilia, hairlike structures that extend from the surface of many cells, can create movement of surrounding fluid. The nuclear envelope, a double membrane surrounding the nucleus, contains pores that control the movement of substances into and out of the nucleoplasm.

Chromatin, a combination of DNA and proteins that coil into chromosomes, makes up much of the nucleoplasm. The dense nucleolus is the site of ribosome production.

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Cells contain a special collection of molecules that are enclosed by a membrane.

These molecules give cells the ability to grow and [reproduce](#).

The overall process of cellular reproduction occurs in two steps: cell growth and [cell division](#). During cell growth, the cell ingests certain molecules from its surroundings by selectively carrying them through its [cell membrane](#). Once inside the cell, these molecules are subjected to the action of highly specialized, large, elaborately folded molecules called [enzymes](#).

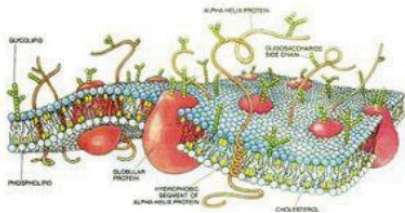
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Parts of the Cell

A. Cell Membrane

1. Separates the cell from its external environment
2. Gives shape and flexibility to the cell
3. Made of 2 layers
4. Made of fats (phospholipids) and proteins
5. Cholesterol is also a part of the membrane
6. "Fluid Mosaic Model" is how scientists refer to its structure
7. Drawing:

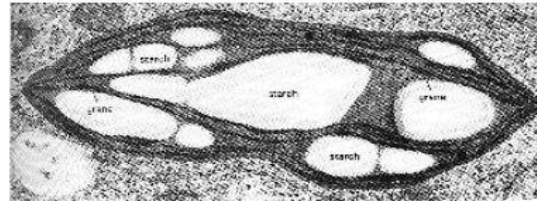


B. Cytosol:

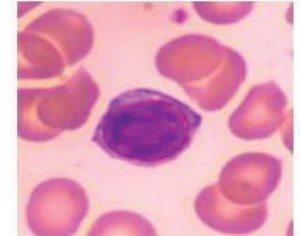
1. jelly like material that contains water, salt, sugars, fats and proteins
2. It is always moving

C. Organelles— "little organ", each performs a specific activity

1. Refer to chart on next page.



The black stuff

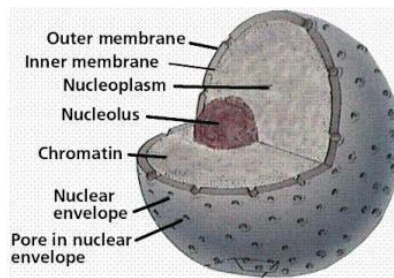
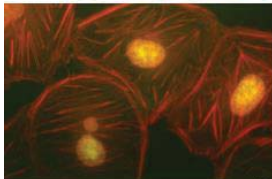


Nucleus is purple,
cytoplasm is pinkish.
This is a lymphocyte

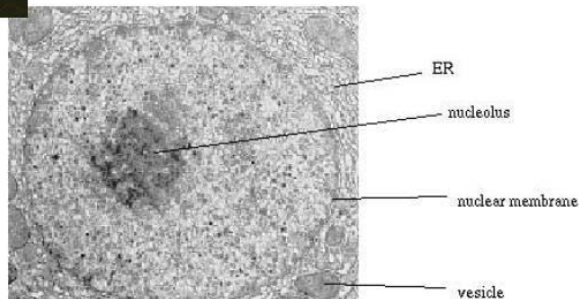
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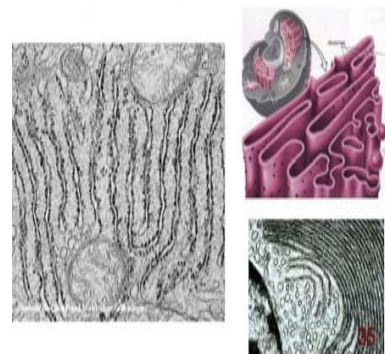
Nucleus



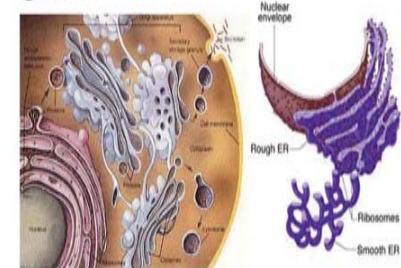
Nucleolus



Rough Endoplasmic Reticulum



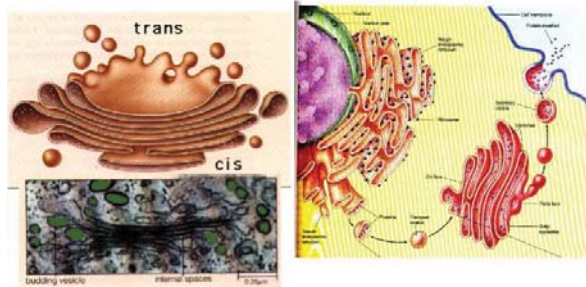
Smooth Endoplasmic Reticulum



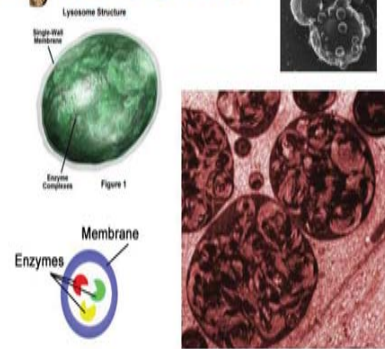
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Golgi Apparatus

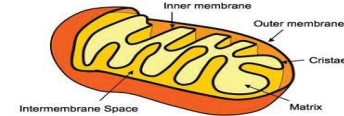
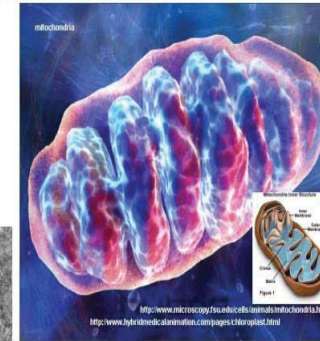
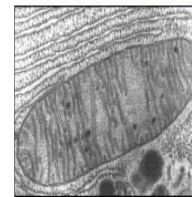


Lysosome



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Mitochondria

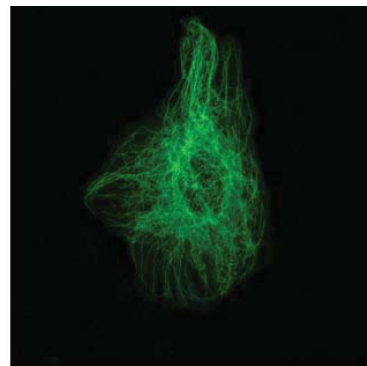


Mitochondria (singular: *mitochondrion*) are double membrane-bound cell organelles with a typical size of $0.75\text{--}3\text{ }\mu\text{m}^2$. Mitochondria have an inner and outer membrane, with an **intermembrane space** between them.

The **outer membrane** contains proteins known as porins, which allow movement of ions into and out of the mitochondrion. The space within the inner membrane of the mitochondrion is known as the **matrix**, which contains the enzymes of the **Krebs** (TCA) and fatty acid cycles, alongside DNA, RNA, ribosomes and calcium granules. The **inner membrane** contains a variety of enzymes. It contains **ATP synthase** which generates ATP in the matrix, the 'powerhouse of the cell', they are the site of the majority of ATP synthesis.

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Microtubule

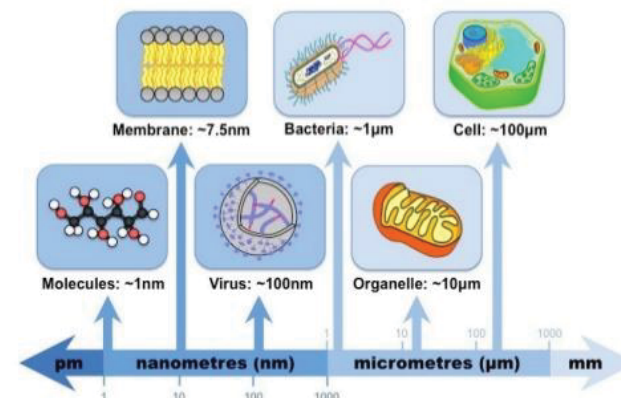


Tubulin...the protein that makes up a microtubule

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1.1.S1 Use of a light microscope to investigate the structure of cells and tissues, with drawing of cells. Calculation of the magnification of drawings and the actual size of structures and ultrastructures shown in drawings or micrographs. (Practical 1)

Relative Sizes of Biological Materials



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