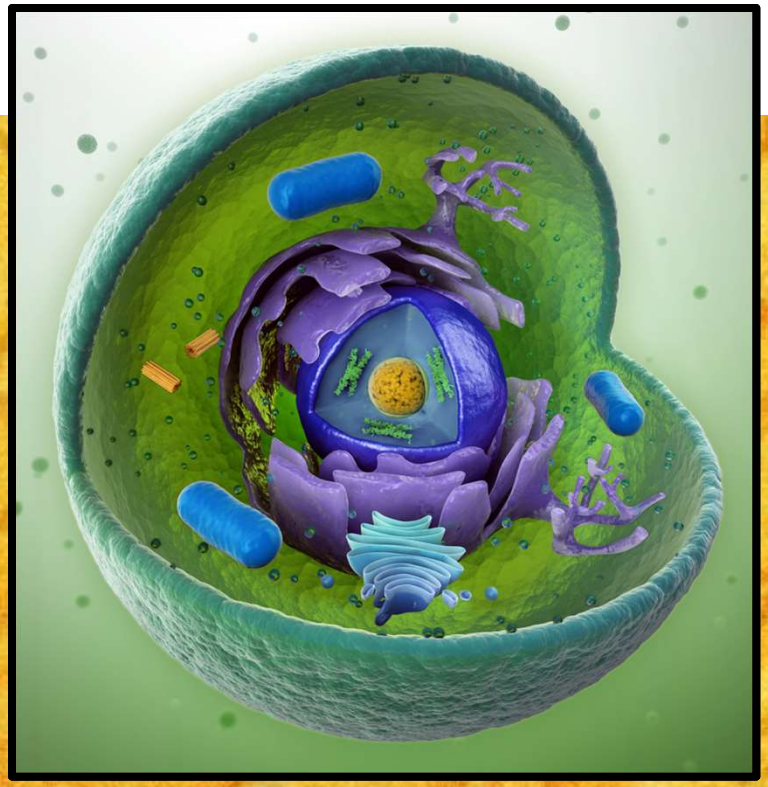
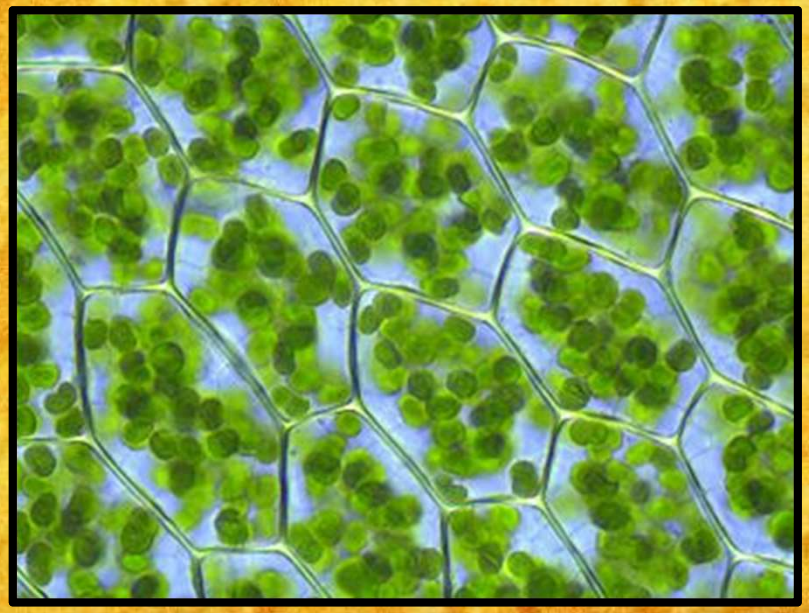
# Cell Structure and Function

EQ: What are the components that make up our cells?



**The Basic Unit of Life**

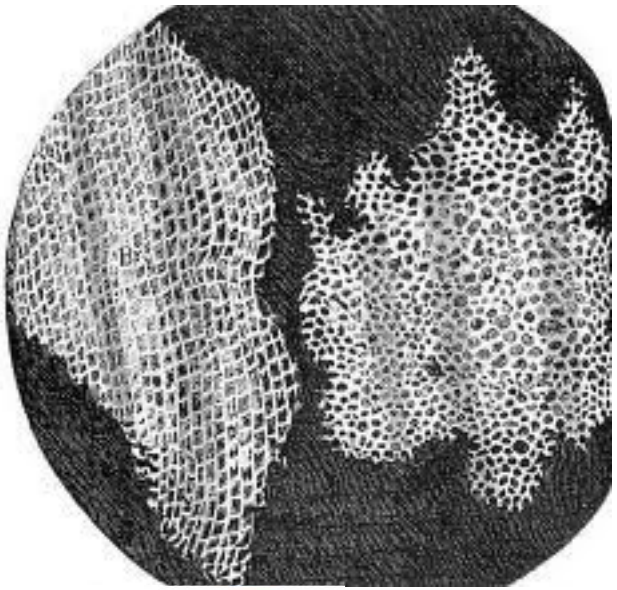


# The Discovery of the Cell

## Robert Hooke

The word "cell" was first used in late 1665 by Robert Hooke. He looked at thin slices of cork (plant cells) under the microscope.

**1665**



Cork seemed to be made of thousands of tiny, empty chambers.

Hooke called these chambers "cells" because they reminded him of the tiny rooms in which he lived in the monastery.

Today we know that cells are not empty chambers, but contain much living matter.

# Anton van Leeuwenhoek – late 1600's

Leeuwenhoek made many simple microscopes to observe things in nature that interested him.

Leeuwenhoek Microscope (circa late 1600s)

He discovered the hidden world of microorganisms in a drop of water. He called them "little beasties."

He was the first to:

**…. see and describe microorganisms under the microscope.**

# On the road to the cell theory…

## Matthias Schleiden


German botanist

**1838**

Schleiden said that all plants are made of cells.

## Theodore Schwann

Zoologist

**1839**


Schwann said that all animals are made of cells.

# Virchow

**1858**

In 1858, Rudolph Virchow said that cells could only arise from preexisting cells.

# The Cell Theory

1. All living things are composed of cells.

2. Cells are the basic units of structure and function in living things.

3. New cells are produced from existing cells.

# Energy Requirements of Living Organisms

**Living organisms need a constant supply of energy to maintain themselves and to grow and reproduce.**

Examples:
All Animals
The Fungi

## Heterotrophs

Heterotrophs cannot make their own food.

They must get it from outside sources.

Heterotrophs are consumers.

# Autotrophs

Autotrophs are producers.

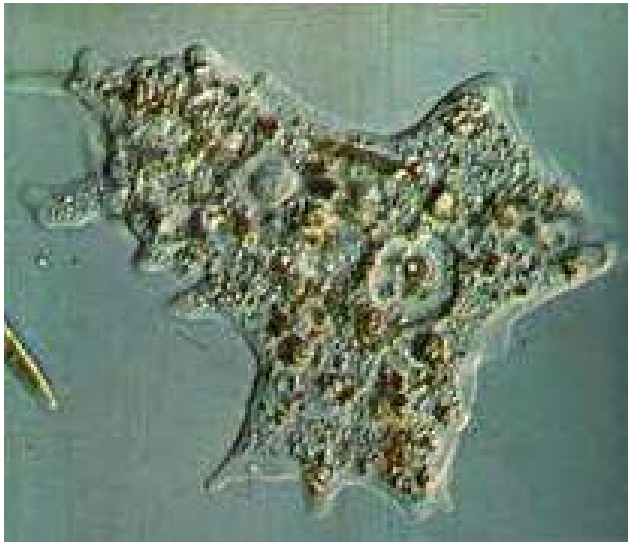
Examples include:

All green plants, some protists, and some bacteria.

Autotrophs
can make their own food
and are not dependent on outside sources for their food.

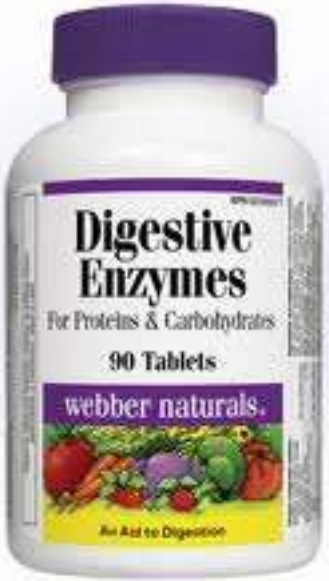
# All cells must be able to perform the following functions.

## Ingestion:



The taking in of food and water.

## Digestion




Breaking down food into small molecules that can be used by the cell.

## Cyclosis:

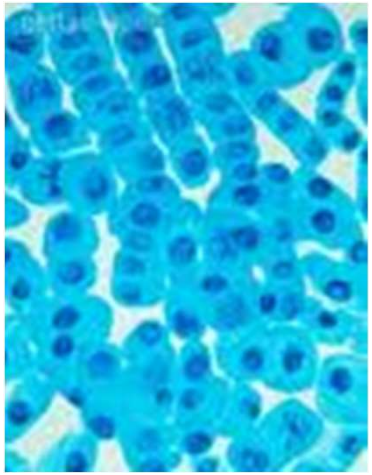
The movement of materials inside a cell.

## Respiration:

Burning food for energy; the release of energy from food.

## Biosynthesis:

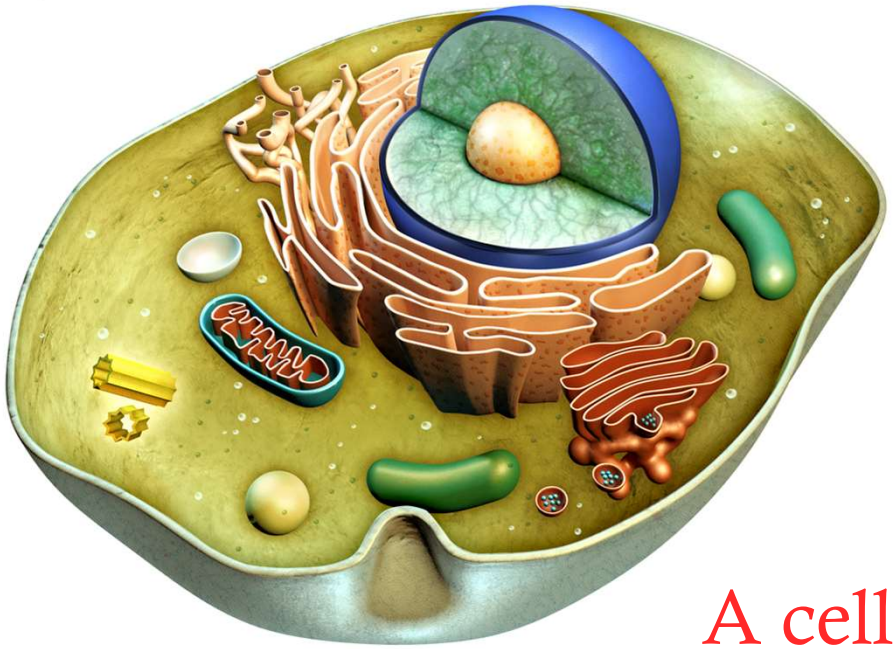
Using the energy from food for growth and repair.



## Excretion:

The removal of liquid waste from the cell.

# Structures of Animal Cells



Organelles are the specialized structures found within a cell.

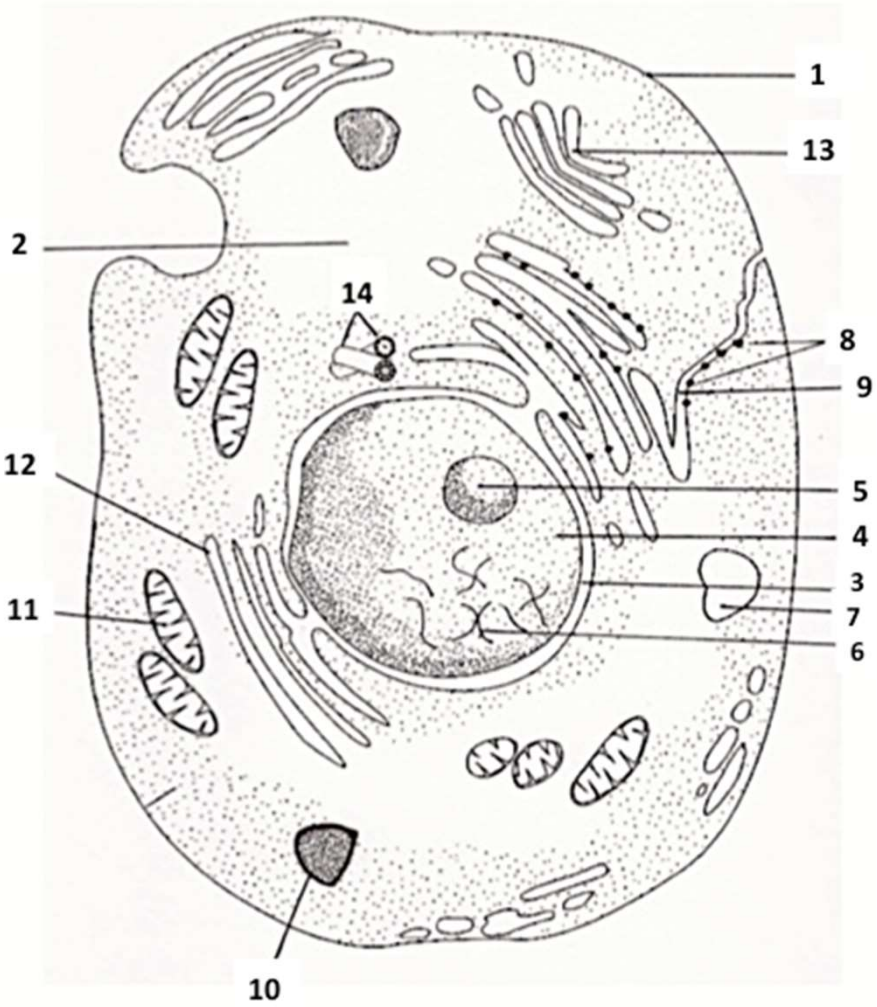
Each organelle has a specific job or function.

A cell is divided into 2 parts:

Nucleus: The control center of the cell.

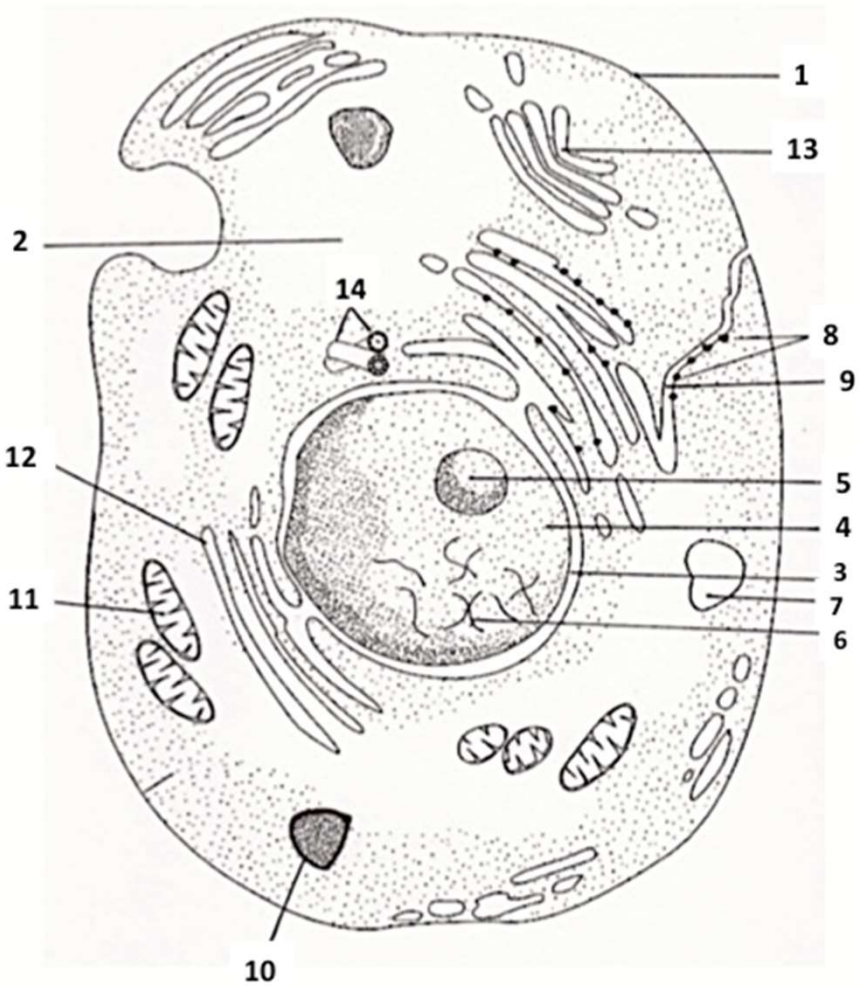
Cytoplasm: The portion of the cell outside of the nucleus.

# Organelles Found in a Generalized Animal Cell

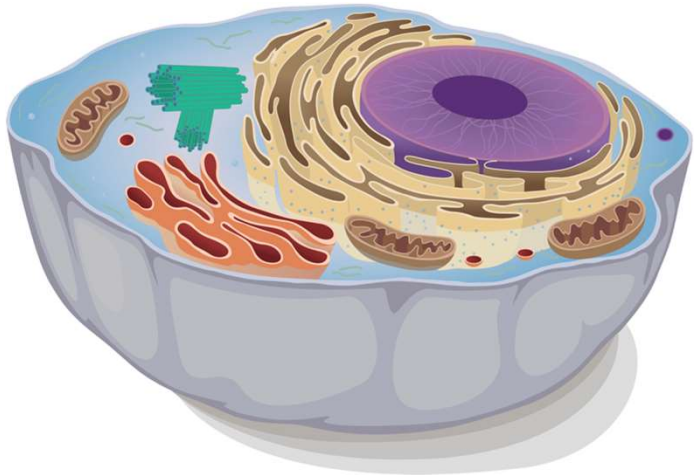



1. Cell Membrane
2. Cytoplasm
3. Nucleus / Nuclear Membrane
4. Nucleoplasm
5. Nucleolus
6. Chromosomes
7. Vacuole
8. Ribosomes
9. Rough Endoplasmic Reticulum
10. Lysosome

# Organelles Found in a Generalized Animal Cell




11. Mitochondria
12. Smooth Endoplasmic Reticulum
13. Golgi Apparatus
14. Centrioles



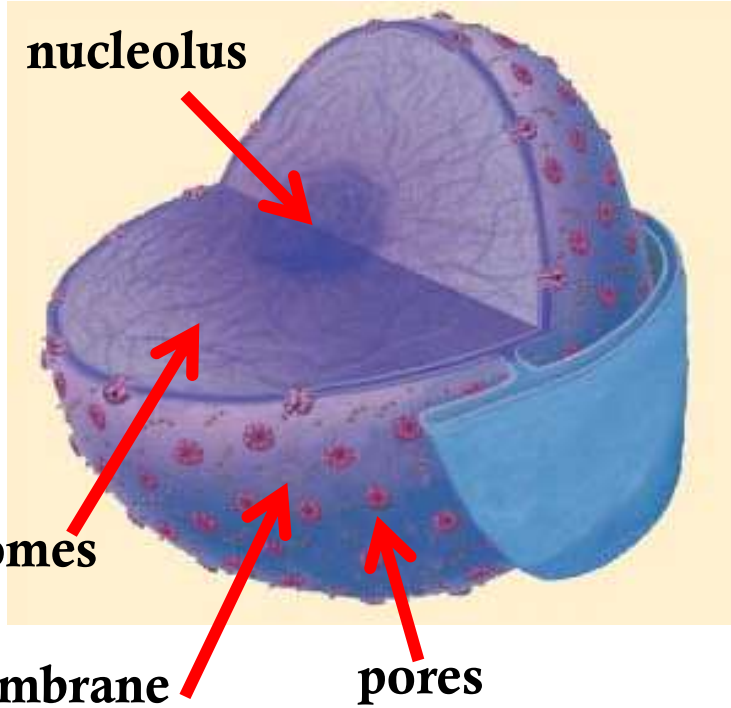
# The Nucleus

The nucleus is the control center of the cell.

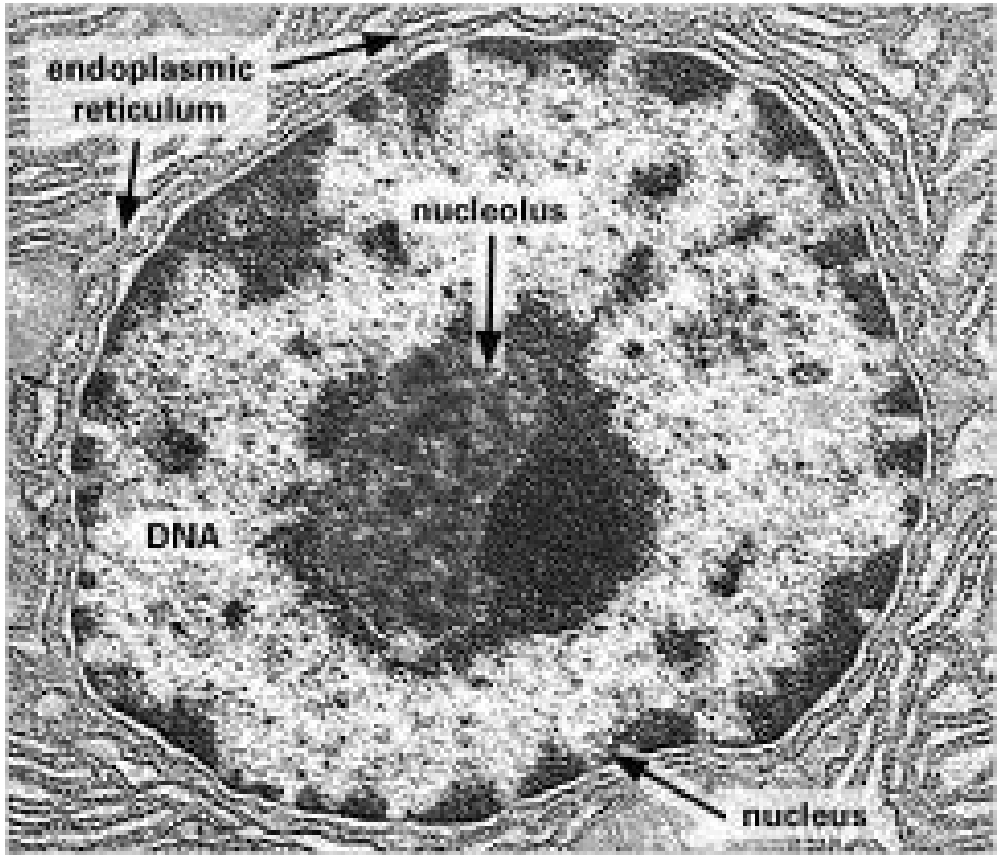
The nucleus contains nearly all of the cell's DNA.

The DNA has the instructions for making proteins and other important molecules.

The nucleus is surrounded by a nuclear membrane.




The nuclear membrane is a double membrane that is dotted with thousands of pores. These pores allows materials to move into and out of the nucleus.

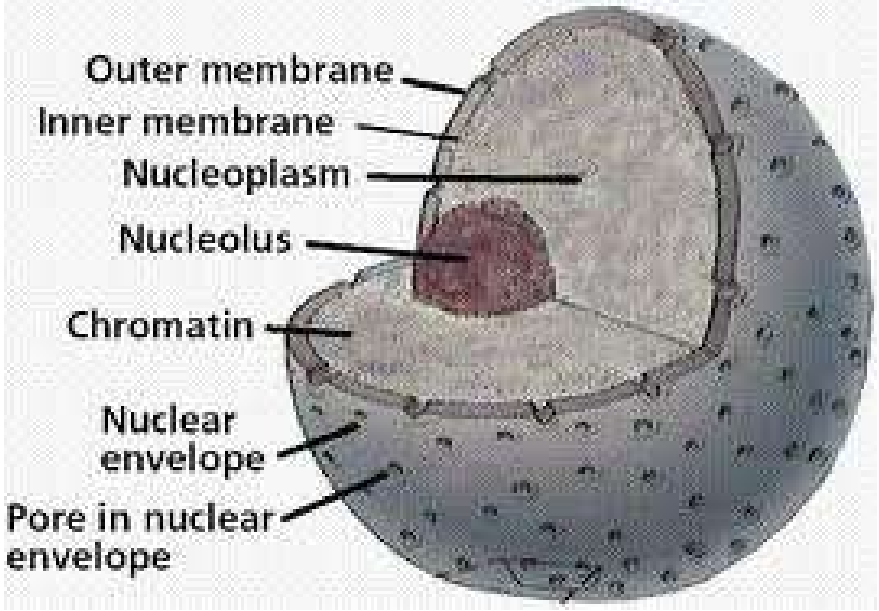



The chromosomes are made of DNA and have two functions:

A) To contain the genetic information that is passed from one generation to the next.

B) To control the cell's activities.

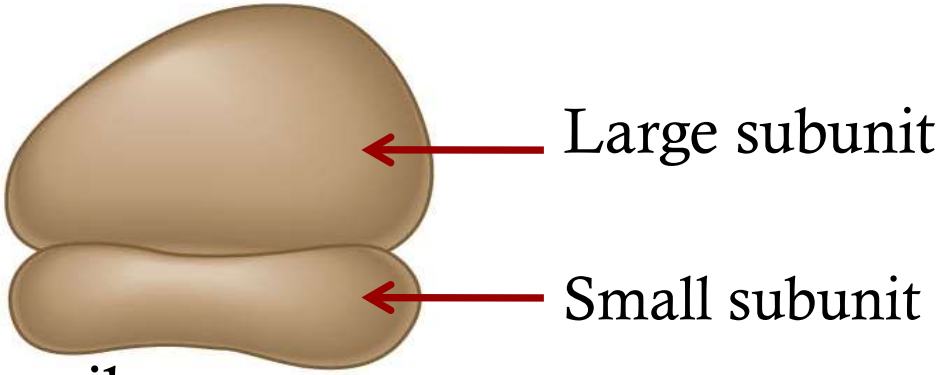
The nucleoplasm is the semi-liquid portion inside the nucleus.




# Nucleolus

The nucleolus manufactures the subunits that make up ribosomes.

There are 2 subunits: the large subunit and the small subunit.




ribosome

**These subunits then pass through the pores of the nucleus to the cytoplasm where they combine to form ribosomes.**

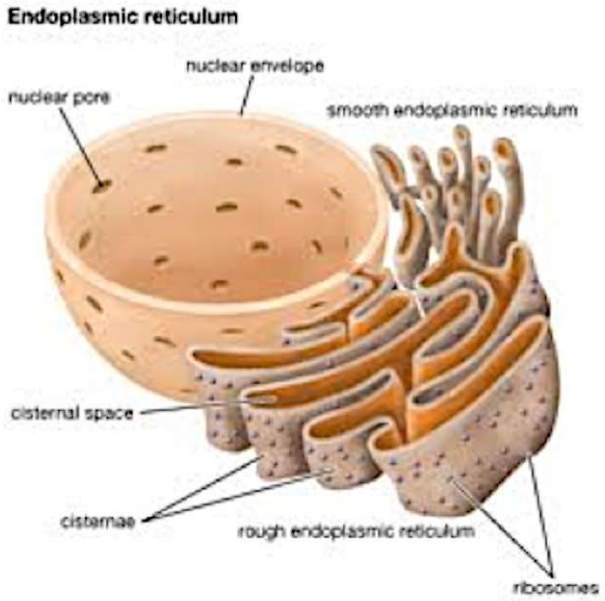
# Functions of the Nucleus

**The nucleus is the carrier of the genetic information because this is where the genes are found.**

| | | |
|---|---|---|
| **The nucleus controls the reproduction of the cell.** | **The nucleus controls all of the activities of the cell.** | **The nucleus directs protein synthesis by sending messages out to the ribosomes.** |

Ribosomes may be found free floating in the cytoplasm, or they may be found attached to the endoplasmic reticulum.

# Ribosomes

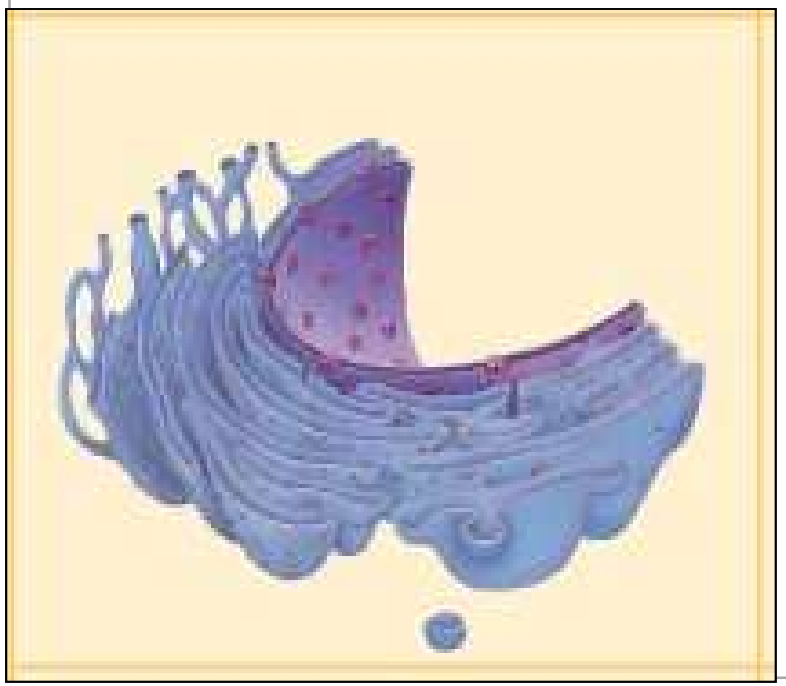




Ribosomes are the most numerous of the cell's organelles.

Ribosomes are the site of protein synthesis. All proteins of the cell are made by the ribosomes.

# Endoplasmic Reticulum

The internal membrane system of a cell is known as the endoplasmic reticulum.



This system of membranes is so extensive throughout the cell that it accounts for more than half the total membrane in a cell.

It connects the nuclear membrane to the cell membrane.


The rough endoplasmic reticulum has ribosomes attached to it.

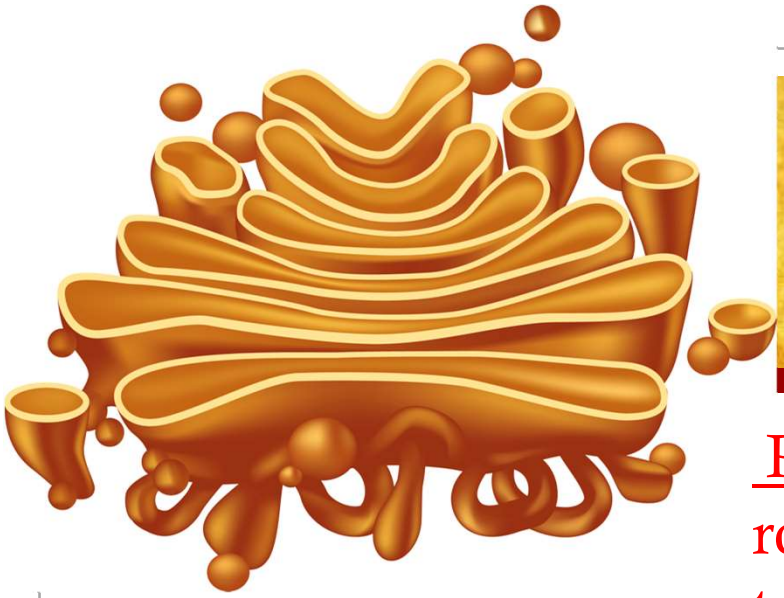
This type of endoplasmic reticulum is involved in the making of proteins.

Newly made proteins leave the ribosome and are inserted into **spaces of the endoplasmic reticulum** where they are **modified and shaped** into a functioning **protein**.

**The smooth endoplasmic reticulum has no ribosomes.**

**The function of the smooth endoplasmic reticulum is to make:**

**lipids that will be used in the cell membrane.**



# Golgi Apparatus

Proteins that were produced in the rough endoplasmic reticulum now move to the Golgi apparatus.

The Golgi apparatus appears as a stack of loosely connected membranes.

The function of the Golgi is to modify, sort and package the proteins that have arrived from the endoplasmic reticulum.

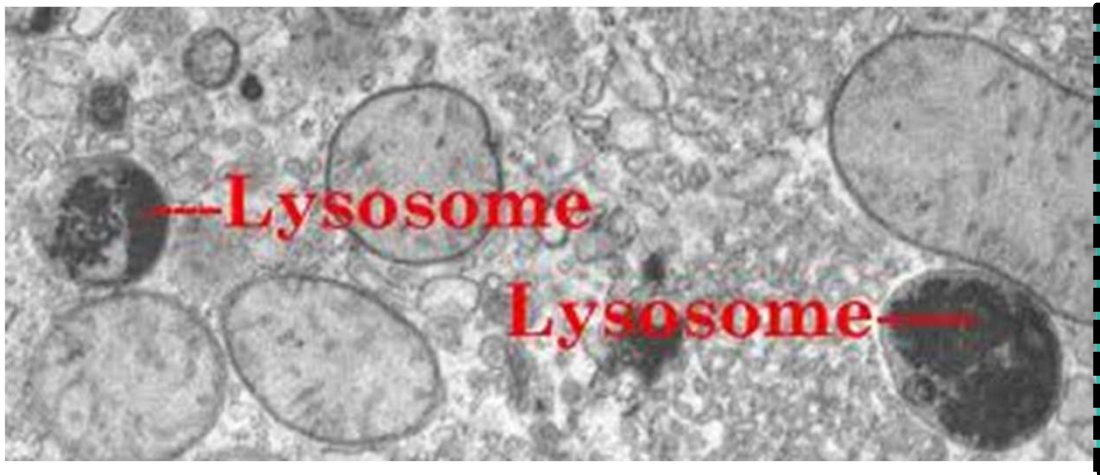
These proteins will either be stored inside the cell or be secreted to the outside of the cell.

The finishing touches are put on proteins here before they are shipped off to their final destinations.

# Lysosomes

**Lysosomes are filled with:**
**very strong digestive enzymes.**

One function is the:
digestion of carbohydrates, proteins, and lipids into small molecules that can be used by the rest of the cell. They recycle the cell's own organic materials, breaking them down into their building blocks, and returning them to the cytoplasm to be used again.

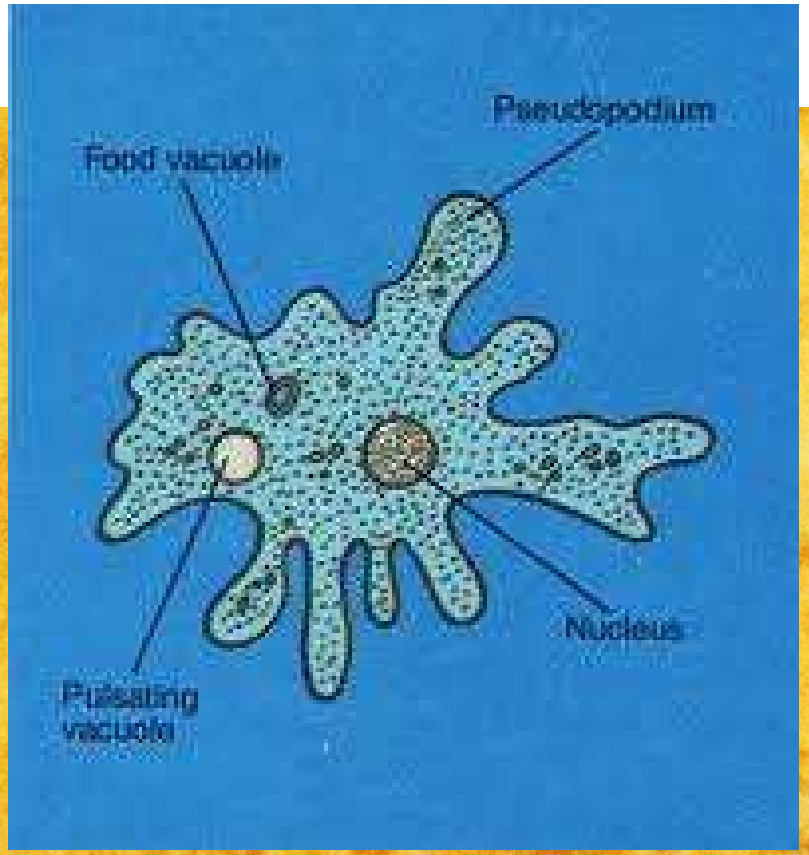



Lysosomes are responsible for destroying old organelles that can no longer carry out their function.

# Vacuoles

A vacuole is a storage area inside a cell.

A vacuole may store water, salts, proteins, and carbohydrates.

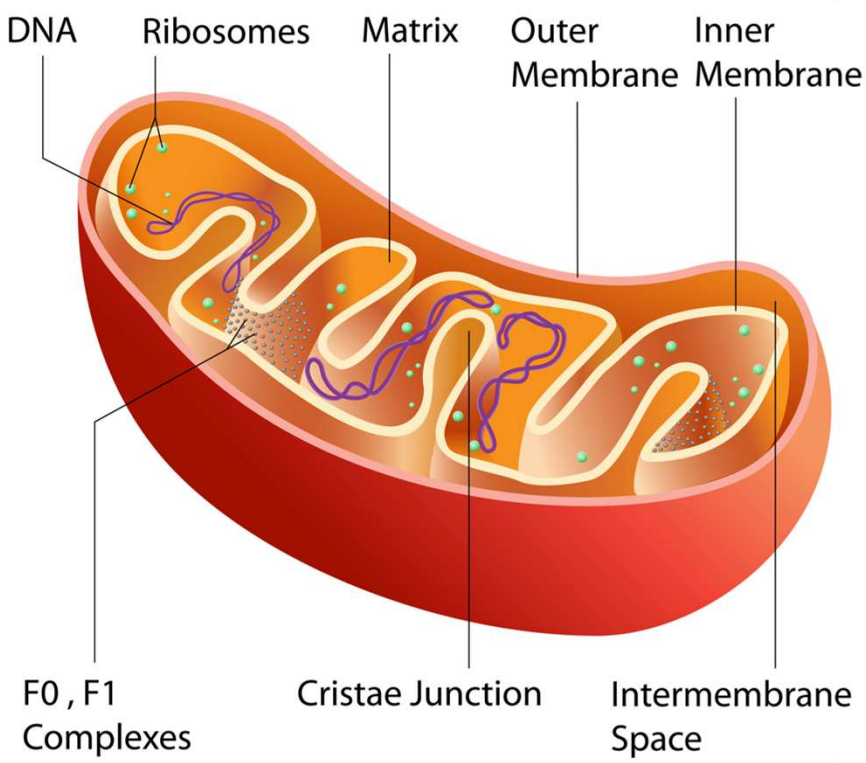


# Mitochondria

The mitochondria is the "powerhouse " of the cell.

The purpose of the mitochondria is:

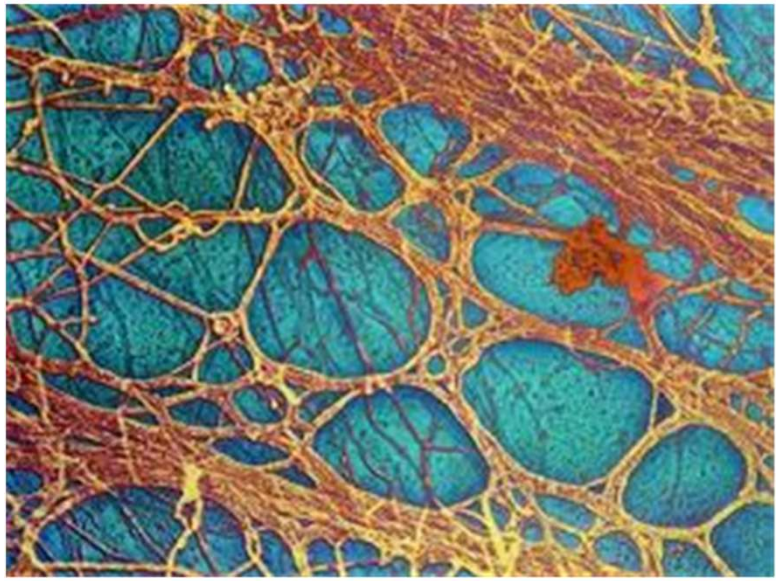
cellular respiration.




Cellular respiration is the process of converting glucose or sugar molecules into a usable form of energy for the cell.

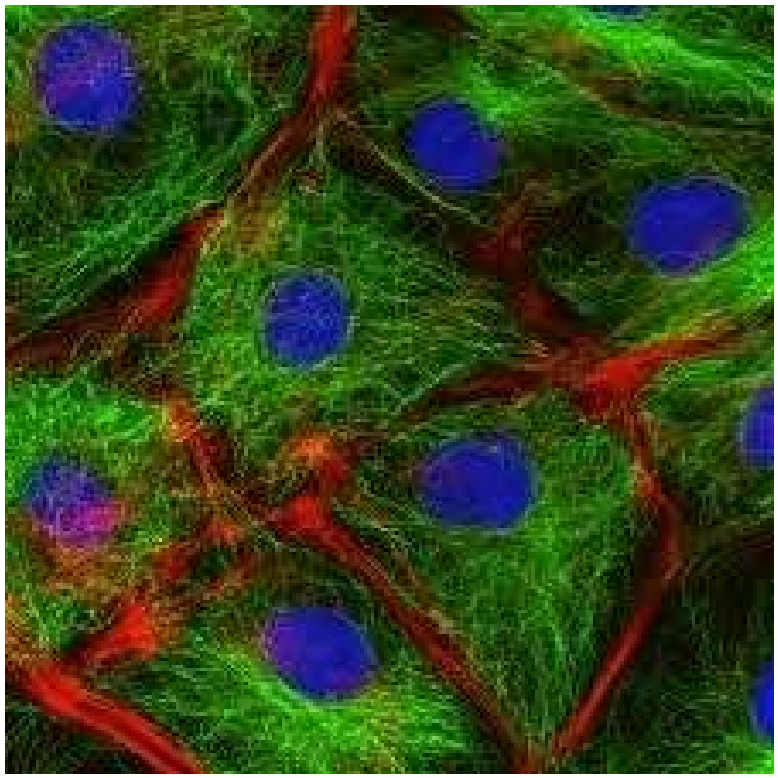
# The Cytoskeleton

The organelles of a cell do not float freely in the cytoplasm.

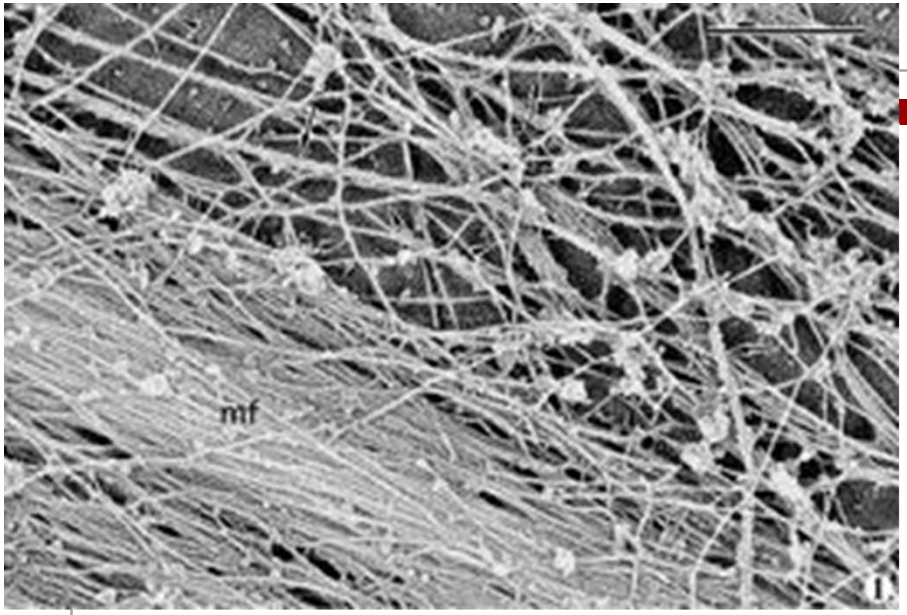


- Cells must have an internal framework and **support system** to give **shape** and organization to a cell.

The cytoskeleton is a network of protein tubes and fibers that helps the cell to maintain its shape.



- The cytoskeleton is also involved in movement.
- Two of the types of fibers found in the cytoskeleton are microfilaments and microtubules.



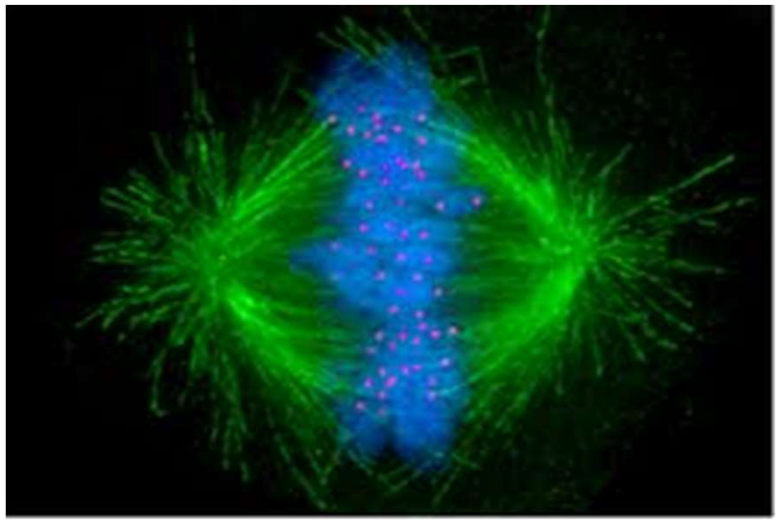

# Microfilaments

Microfilaments also help cells to move. They can assemble and disassemble rapidly causing movement.

Microfilaments are …
…solid, threadlike, protein structures.

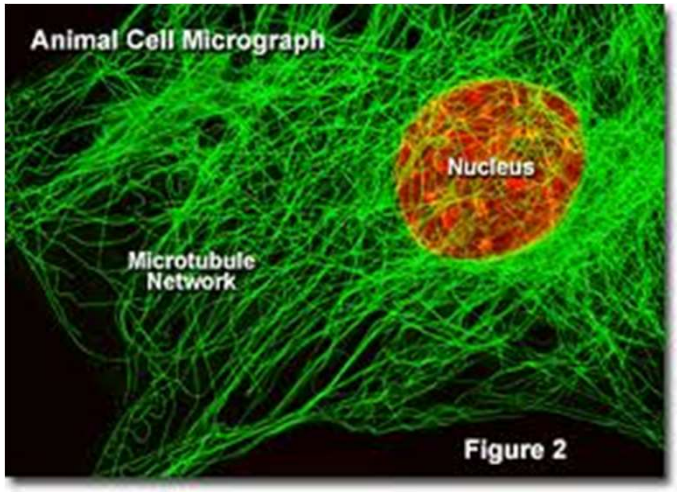
Microfilaments form extensive frameworks inside the cell to give support to the cell. They help to bear mechanical stress.

# Microtubules are hollow structures. Functions include:



- The separation of chromosomes during cell division

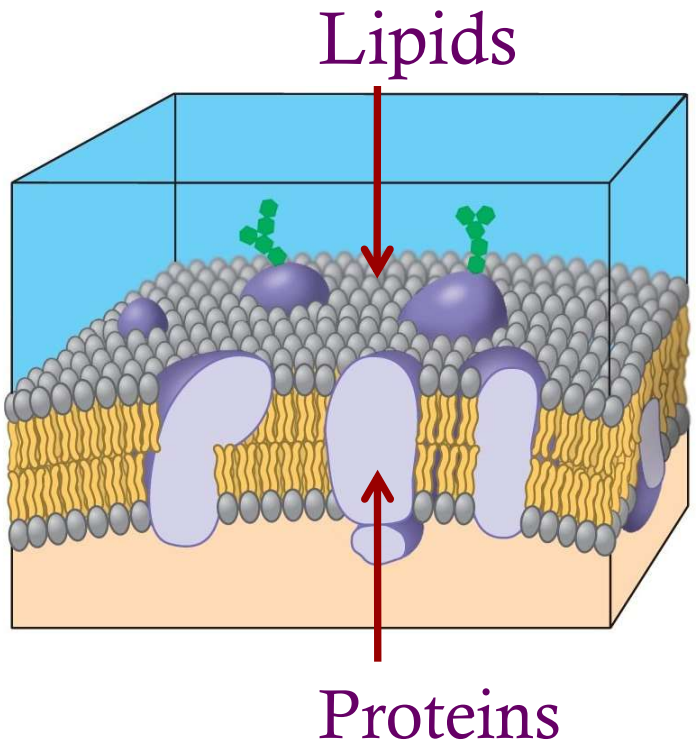
- Cell Shape




- The formation of cilia and flagella

# The Cell Membrane

- Also called the plasma membrane.
- Maintains the shape of the cell.
- Separates one animal cell from the next.
- Regulates the passage of materials into and out of the cell.




- Made mostly of lipids and proteins.