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# Chapter: Life's Structure and Classification

Section 1: Living Things

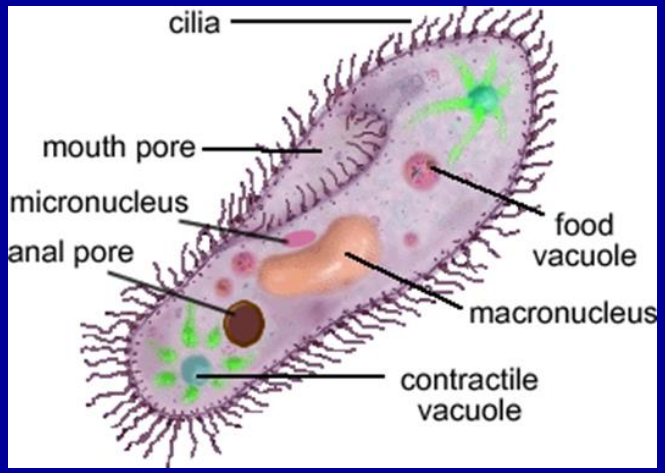
# 1- What is an organism?

Any living thing is called an **organism.**

Organisms vary in size:

1)one-celled or unicellular – organisms that are one cell only

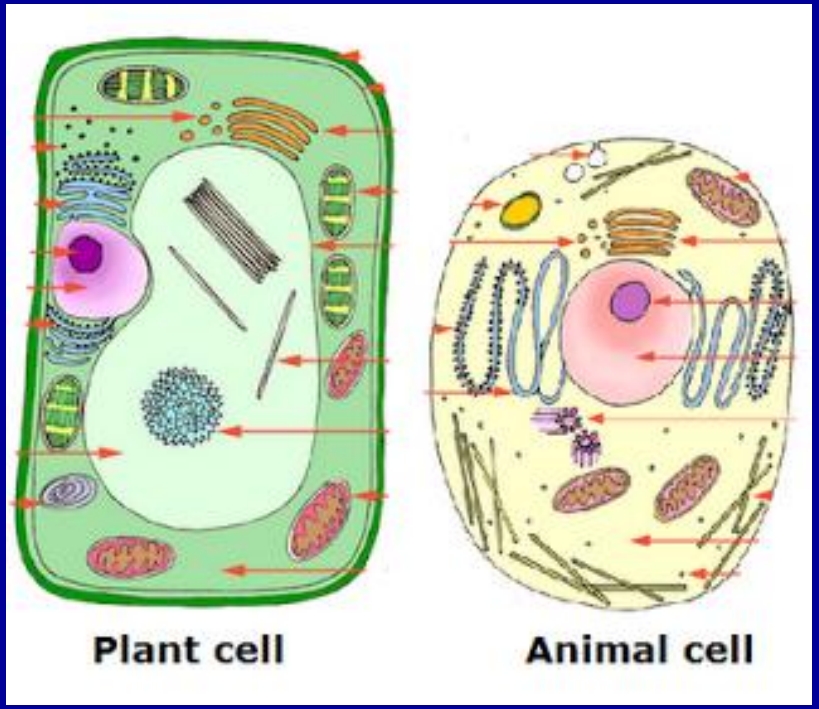
2)many-celled or multicellular – organisms made of more than one cell




# 2- What is a cell?

A **cell** is the smallest unit of an organism that carries on the functions of life.

***Cells are the building blocks of life.**



***What are the main differences between living and non-living things ?**

***All living things have similar traits that determine what it means to be alive.**

- Composed of cells
- Living things grow and develop
- Can reproduce
- Maintain internal balance ( homeostasis)
- Need energy to survive (food)
- Respond to stimuli from the environment

# *Living Things Are Organized

**Unicellular Organisms and Cells are internally organized**

**Cells have internal structures ( organelles) responsible for certain functions that will keep the cell alive**

**Multicellular Organisms are also organized**

**Organisms have internal structures ( cells, tissues, organs and systems) responsible for certain functions that will keep the organism alive.**

## *In a Multicellular organism:

Each cell carries on its own life functions but also performs a job for the whole organism.

Ex: **Muscle cell** – perform a job for the organism – help with the contraction of the muscle and provide the necessary energy for this contraction

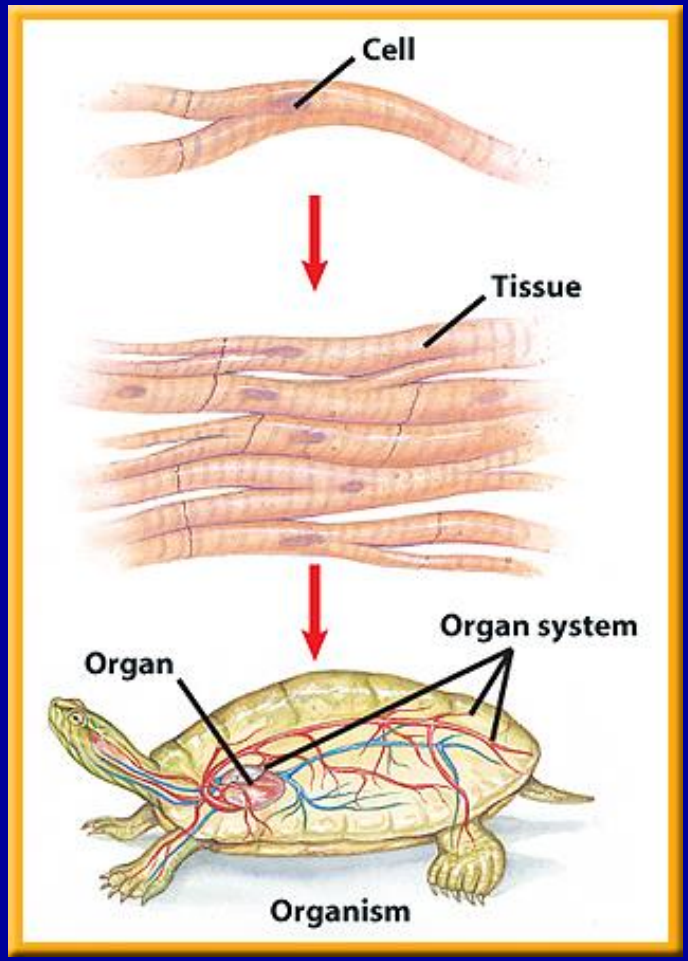
Also needs to perform basic functions to be alive.

***Levels of Organization of a many-celled organism or multicellular organism:**

Cells – tissues- organs – organ systems – organism

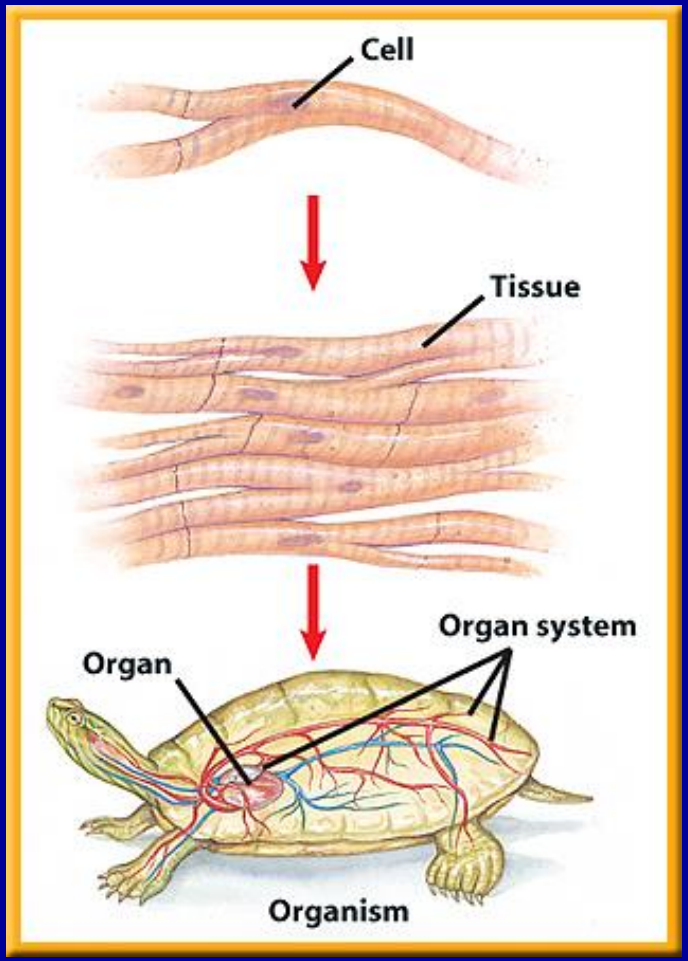
# Many-Celled Organisms

- A **tissue** is a group of similar cells that work together to do one job.
- Tissues are organized into organs.



# Many-Celled Organisms

- An **organ** is a structure made up of two or more different types of tissues that work together.



# Many-Celled Organisms

- A group of organs working together to perform a specific function is an **organ system.**

**** All the functions that organisms perform to survive, are also performed at a cellular level – respiration, digestion, elimination of waste materials….**

**All the things an organism can do are possible because of what their cells can do**

# 3- How do organisms grow?

- Growth of organisms is mostly due to an increase in the **number of cells.**

# Life Span

Is the length of time an organism is expected to live.

- Humans – 80 years
- Some insects – live one day
- Some pine tress can live 4600 years

# 4- How do living things interact with its surroundings and maintain internal balance?

- By responding to stimuli ( plural).
- A stimulus ( singular) is anything that change in the environment that can affect the organism’s internal equilibrium.

**The reaction to a stimulus is a called a response and responding to stimuli is important for the survival of this organism.**

- Ex:

Stimulus – someone pinches you on your arm unexpectedly

Response – move the arm away quickly.

# 5- What is Homeostasis?

- The regulation of an organism's internal, life-maintaining condition despite changes in its environment is called **homeostasis**.

- **** Series of mechanisms responsible for maintaining internal balance of an organism.**

**EX: Homeostasis keeps our body temperature constant**

**Temperature drops in the environment is the stimulus**

**What would be the responses????**

1) you feel cold and start shaking

shaking – produces heat and warms up your body

2) vasoconstriction – superficial veins contract, lowering the surface exposed to the outside - decreases heat lost

Both responses try to maintain the ideal body temperature, which is part of the body's equilibrium

# 6 - How do organisms obtain E?

- The energy used by most organisms comes either directly or indirectly from the Sun.

*Some are producers

*Others will eat the producers to obtain the energy

- Four ways in which an organism can obtain energy:

# Organisms that can synthetize their own food – producers

## How do they obtain Energy????

****1)Photosynthesis** – some organisms use sun's energy, water and carbon dioxide to produce their own food

****2)Chemosynthesis –** process in which organisms produce their own food in the absence of light. The source of energy is a chemical substance.

# Organisms that can't synthetize their own food – consumers

## How do they obtain Energy?

****1) Cellular Respiration-** organisms that can't produce their own food will eat the photosynthetic organisms and break this food in the presence of **oxygen**, producing E and carbon dioxide.

# Organisms that can't synthetize their own food – consumers

****2) Fermentation** - the chemical breakdown of a substance by bacteria, yeasts, or other microorganisms producing carbon dioxide and energy.

****Used by microorganisms when oxygen is not available.**

The process of fermentation is involved in the making of beer, wine, and liquor, in which sugars are converted to ethyl alcohol.

# 7- Why do Living Things Reproduce ?

- All living things reproduce, to make more of their own kind.

*The main goal of any living organism is to reproduce to guarantee the survival of the species

# 8 - What do living things need to survive?

1) a place to live with enough space to grow

2) water – needed for many basic cell functions

3) Food – give them energy

All living organisms need proteins, minerals, vitamins, carbohydrates ( sugars) and fat to survive and organisms take in these materials when they eat.

# **What differentiates plants from animals?

- Plants can make their own food and animals can’t
- Plants take in carbon dioxide and release oxygen, animals do the opposite
- Animals can move and plants can’t
- Unlike animals, plants have little to none ability to sense
- Plant and animal cells are different

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# Chapter 8: Life's Structure and Classification

Section 3: **Cell Structure**

**a) The Cell Theory**

**b) Cellular organization**

## a) The Cell Theory:

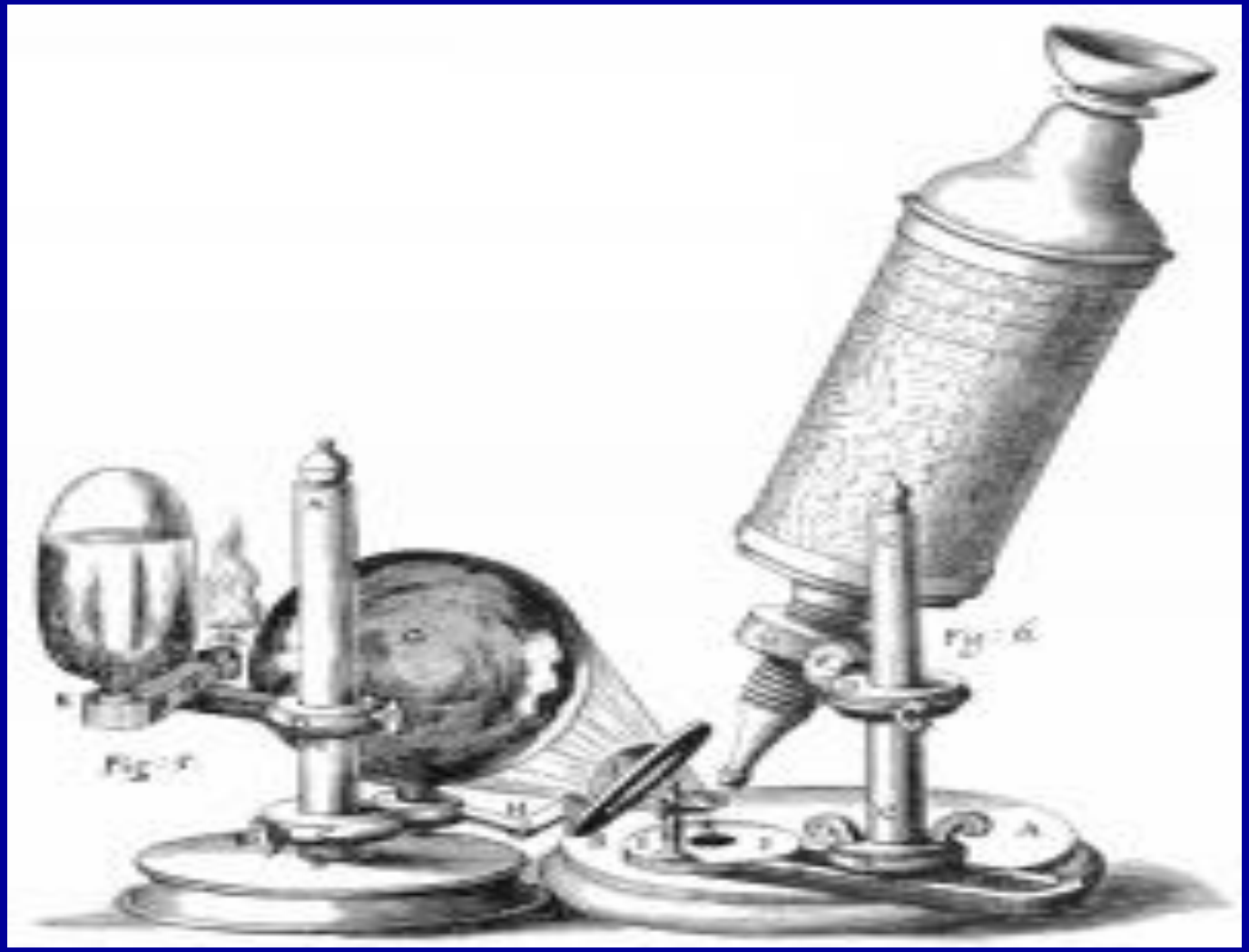
# Viewing Cells

Microscope allowed us to understand that we are all made of cells

1500 - Dutch man – created the first microscope

1600 - Antoine van Leeuwenhoek – Improved the microscope allowing the development of the **cell theory**

# Antoine van Leeuwenhoek's microscope



# Compound Microscope

Compound – more than one lens

Uses light that shines through the specimen,

lens will magnify the image

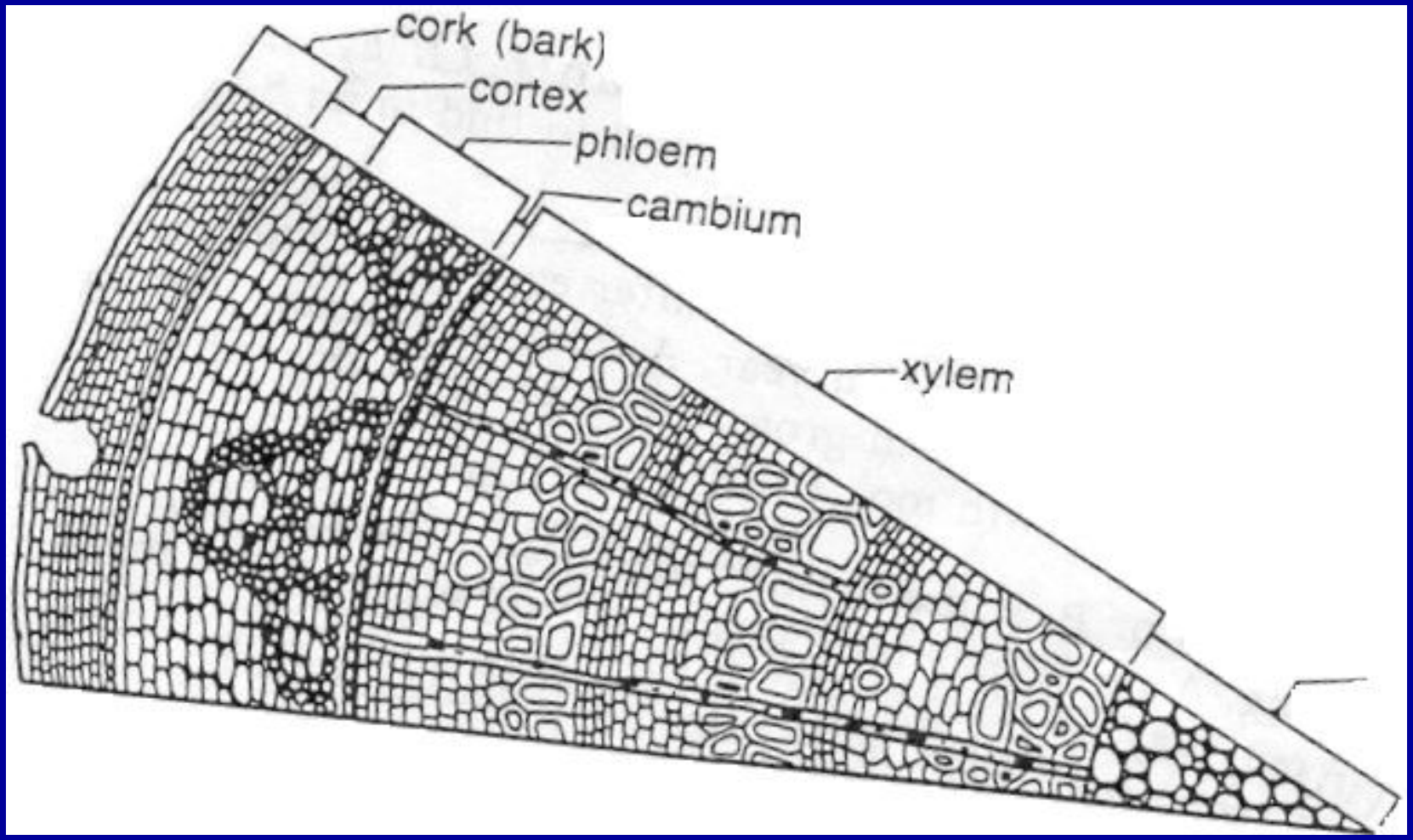
## The Cell Theory:
## describes the existence of cells in organisms

**There are important events that led to the cell theory**

# I – Robert Hooke - 1665

- Looked at cork under a microscope
- He saw a lot of "empty little boxes"
- He named this little boxes **cells**.

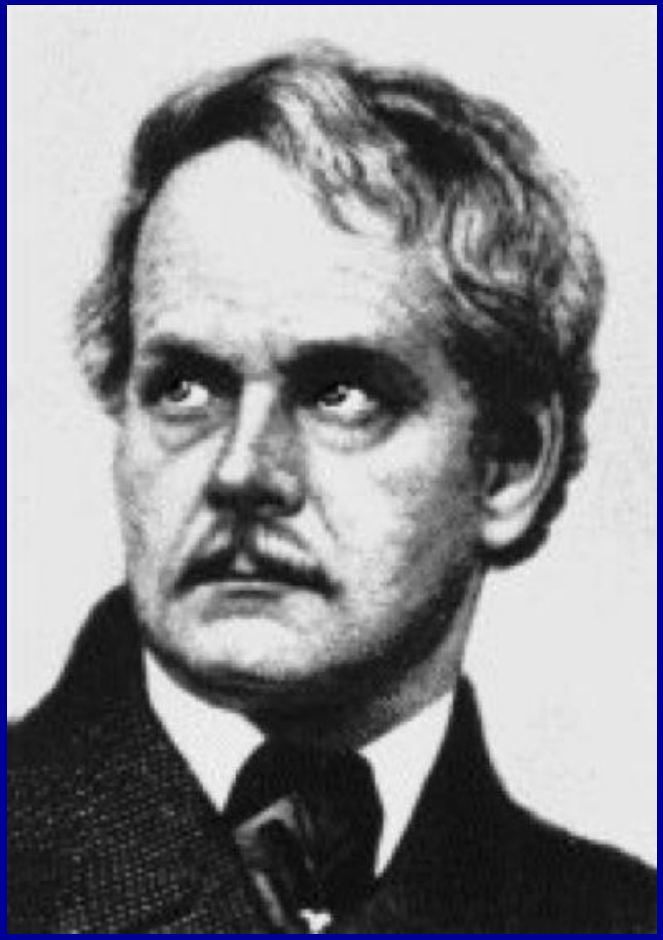
# Cork or Bark is the external layer of stems and roots of woody plants



# Cork Cells

# II- Matthias Schleiden

- In the 1830s, Matthias Schleiden used a microscope to study **plant** parts.
- He concluded that **all** plants are made of cells.



# III- Theodor Schwann

- Observing different **animal** cells
- Concluded that all animals also are made up of cells.

# IV – Virchow

- Several years later, Rudolf Virchow hypothesized that **cells divide to form new cells.**

# ** Summary of the **cell theory**.

| The Cell Theory | |
|---|---|
| All organisms are made up of one or more cells. | An organism can be one cell or many cells like most plants and animals. |
| The cell is the basic unit of organization in organisms. | Even in complex organisms, the cell is the basic unit of structure and function. |
| All cells come from cells. | Most cells can divide to form two new, identical cells. |

# Looking at Cork Cells

# Cellular Organization

**Definition of cell:**

****Cells** are known as the building blocks of life

**2nd definition :

smallest unit of an organism
that can carry on life functions

**Like all living organisms, cells must constantly take in nutrients, store, produce, breakdown substances, take in and use energy.

These are the basic functions that will maintain any organism and any cell alive.

# **Cellular Organization is necessary to perform life functions

Cells are internally organized and all the functions that organisms perform to survive, are also performed, at a cellular level – respiration, digestion, elimination of waste materials….

**In our bodies, we have organs and systems that are responsible for these functions.

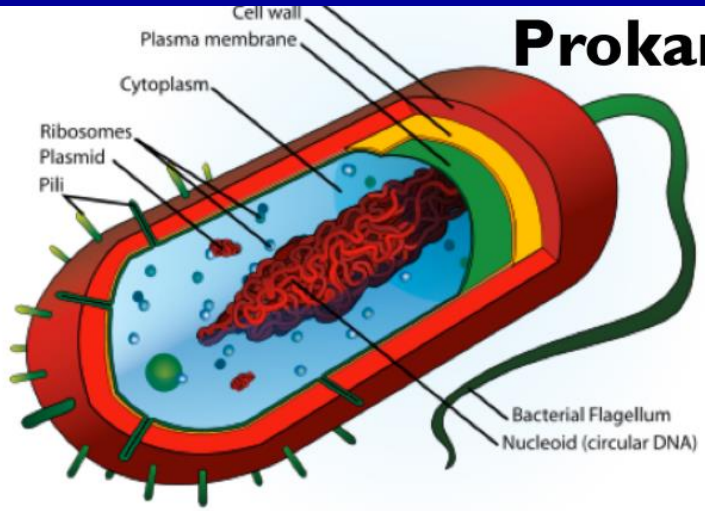
** The cells have organelles that will perform these functions.

# ** Cellular Organization

Cells have internal compartments, surrounded by membrane, called organelles.

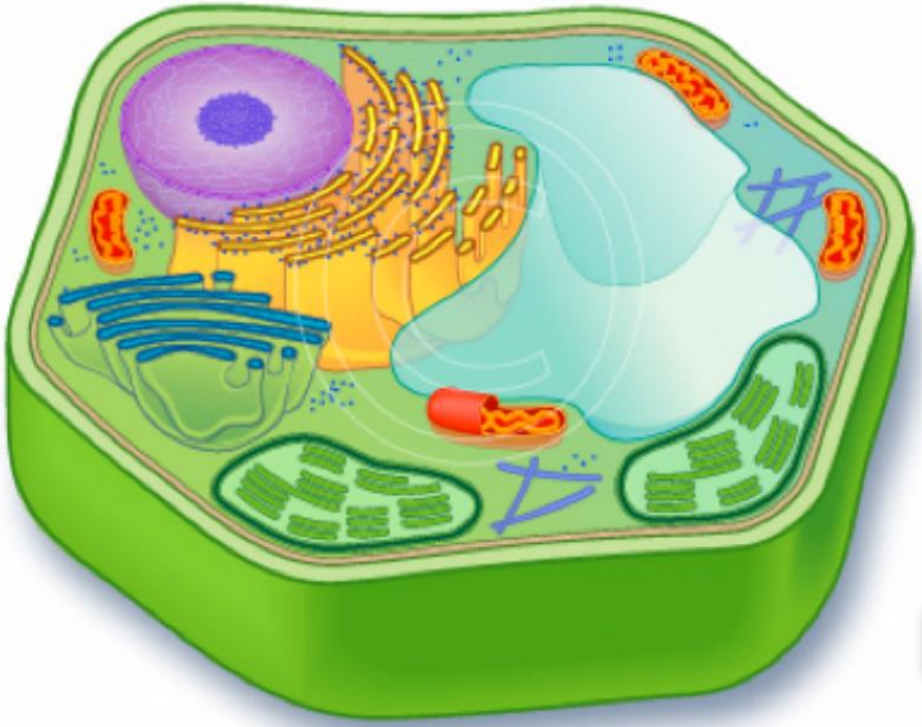
Each organelle has a specific function.

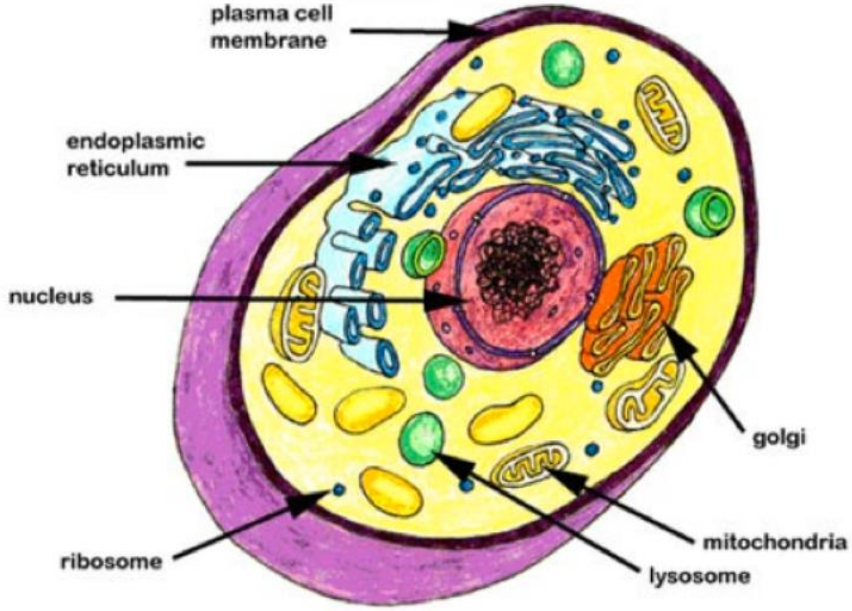
# Prokaryotic x Eukaryotic Cell




**Prokaryotic Cell (Bacteria)**

**Eukaryotic Cell (Plant)**



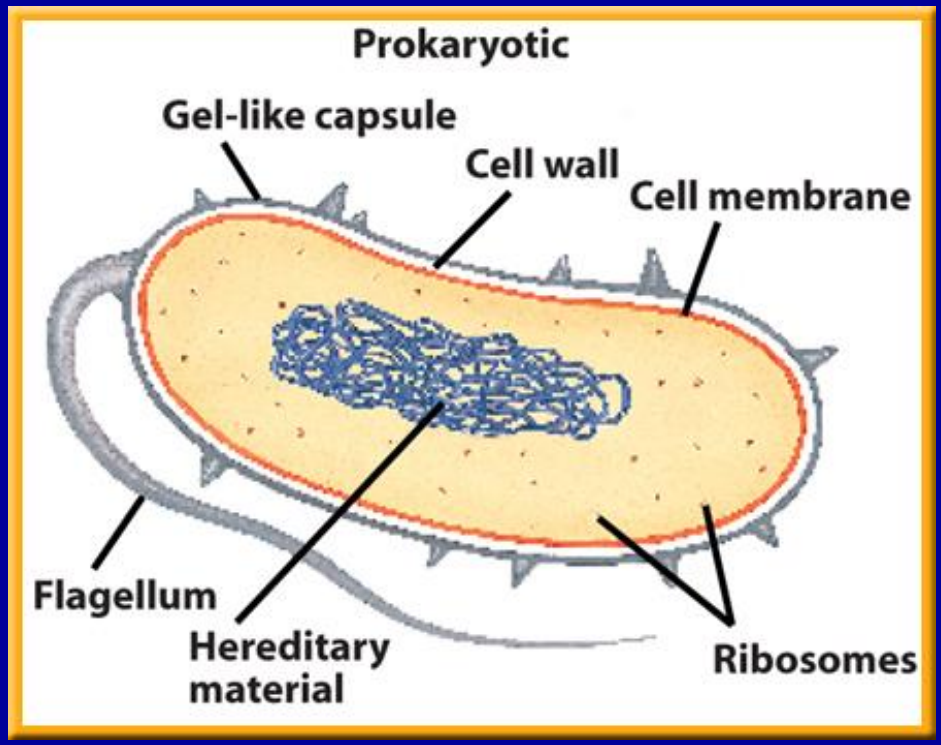



**Eukaryotic Cell (Animal)**

3

# Prokaryotic and Eukaryotic cells.

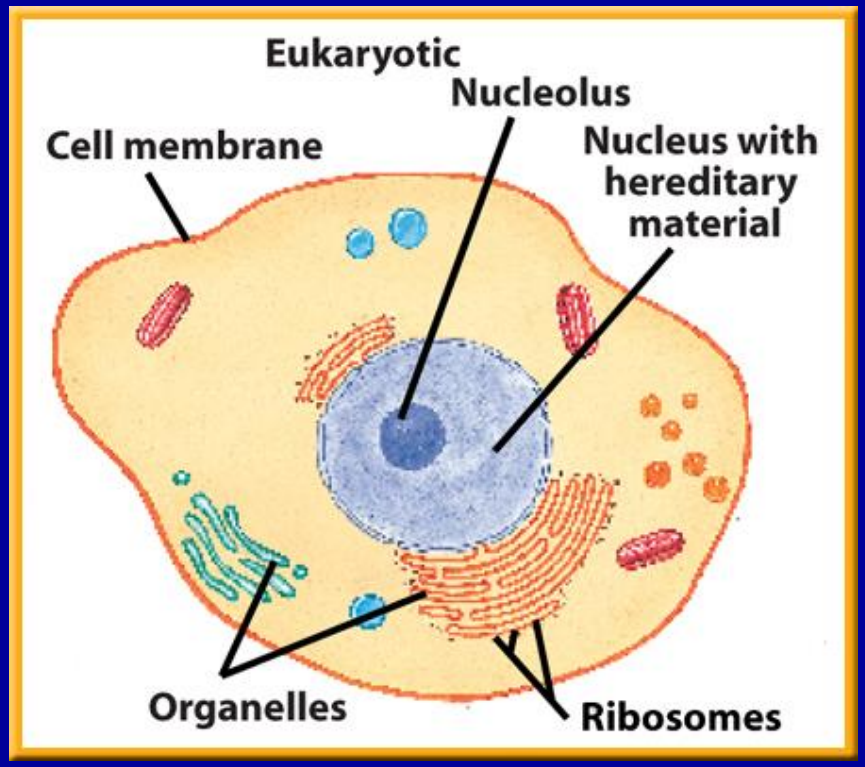
- Cells without membrane-bound structures are called prokaryotic cells.
- ( no nucleus, no organelles, DNA floating in the cytoplasm)



# Cell Structure

3

- Cells with membrane-bound structures **( or organelles)** are called Eukaryotic cells.

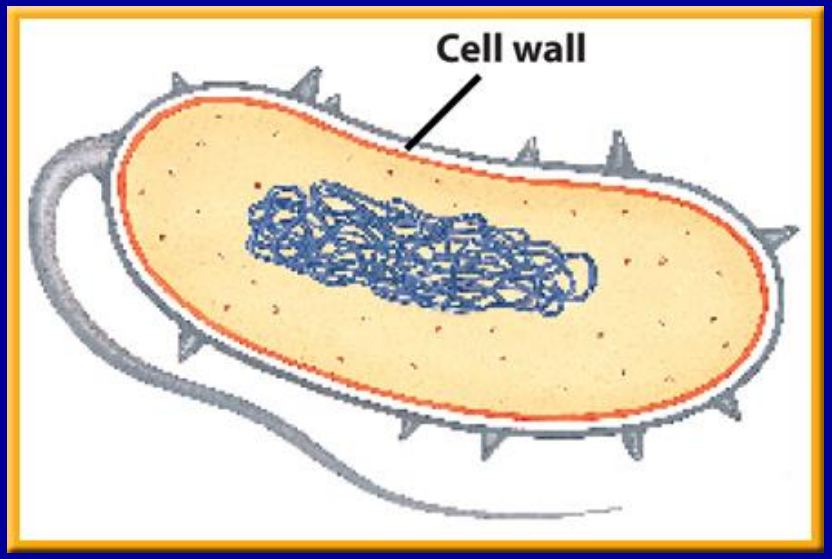



The DNA or genetic material is inside the nucleus

# Cell Wall

**Cell walls** are tough, rigid outer coverings that **protect** cells and give them **shape.**

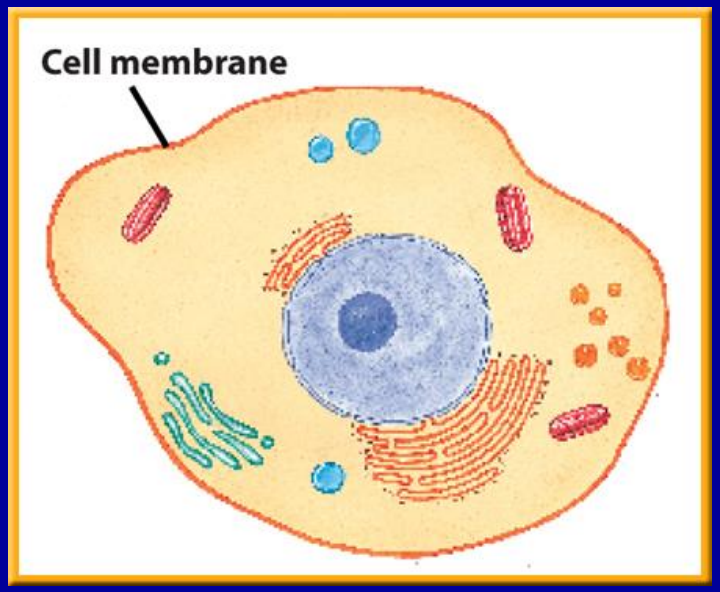
**Plants, Algae, Fungi, and most Bacteria are enclosed in a cell wall.**




- A plant cell wall is mostly made up of a carbohydrate called cellulose.

# Cell Membrane

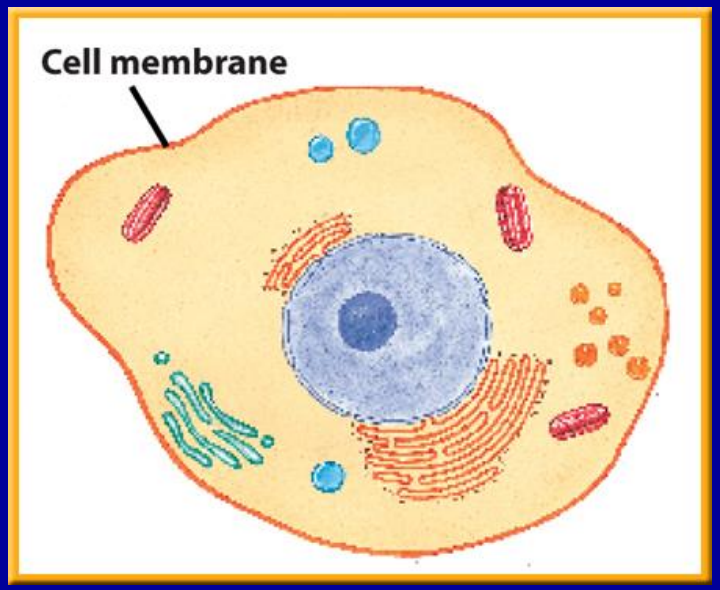
- The protective layer surrounding every cell is the cell membrane.



# The functions of the Cell Membrane

**Protection**

**Regulation of what moves in and out of the cell**



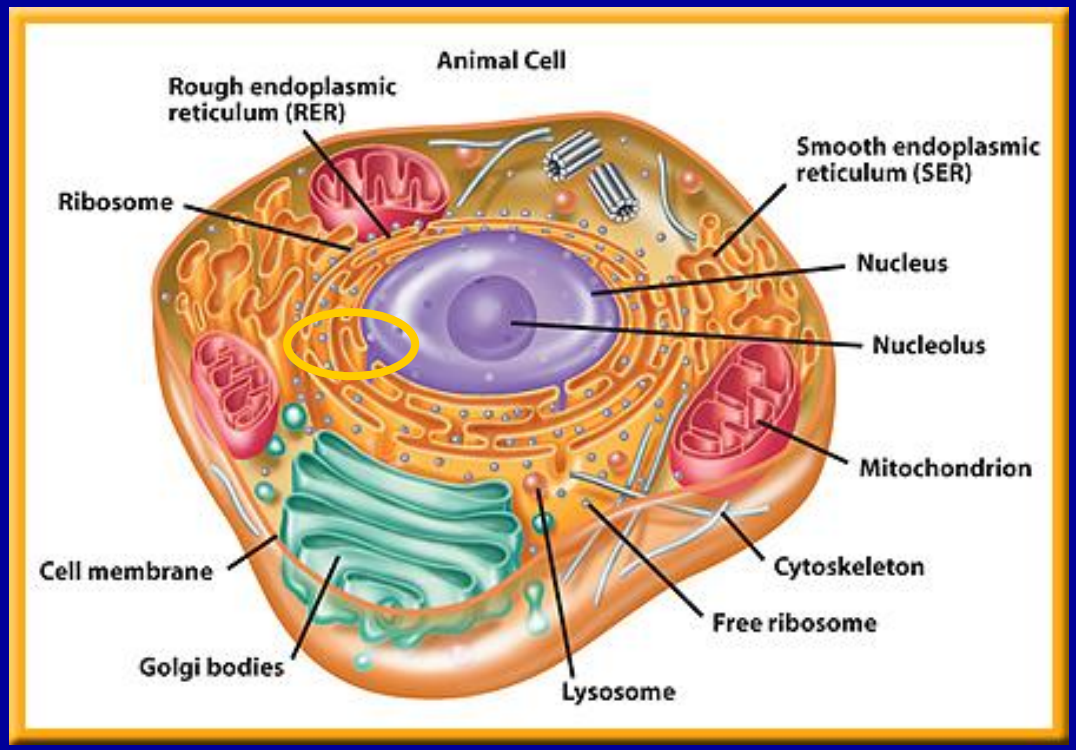

Allows **nutrients** to move into the cell

Allows **waste products** to move out of the cell

# Cytoplasm

- **Gelatin like** substance that constantly flows inside the cell membrane.
- **Organelles** are in the cytoplasm
- Most of a **cell's life processes** occur in the cytoplasm.

# Ribosomes and the functions of ribosomes




- Ribosomes are organelles that **participate in the synthesis of proteins.**

They can be **free** in the cytoplasm or **attached** to the Rough Endoplasmic Reticulum **(RER)**

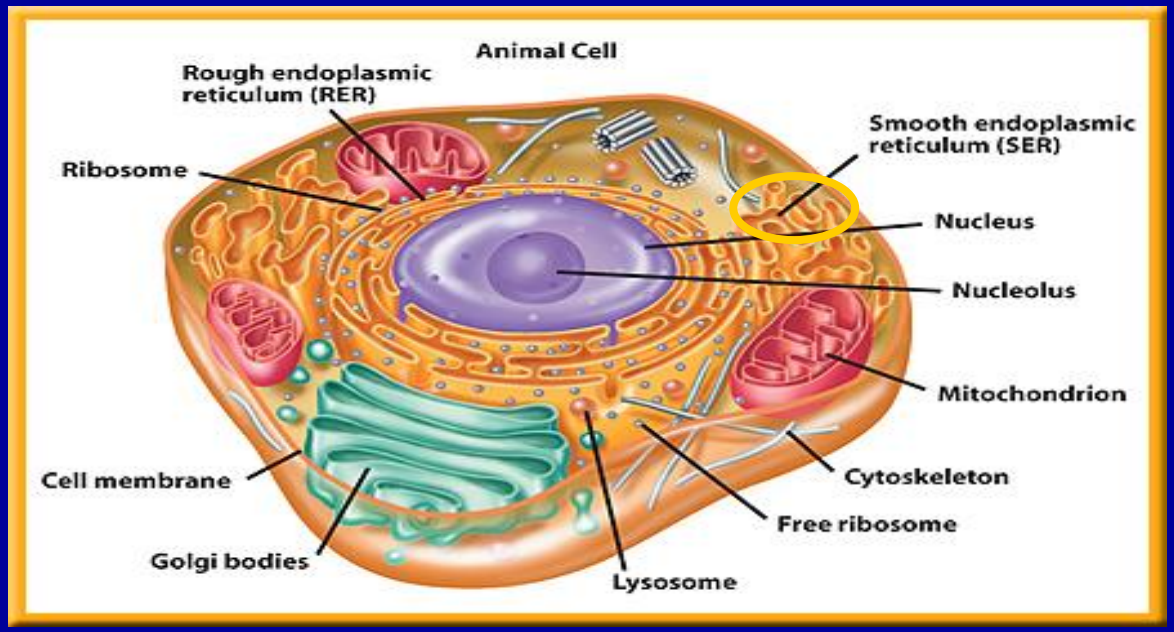
# The importance of the Nucleus.

- All **cellular activities are directed** by the nucleus.
- Contains the hereditary material or **DNA**

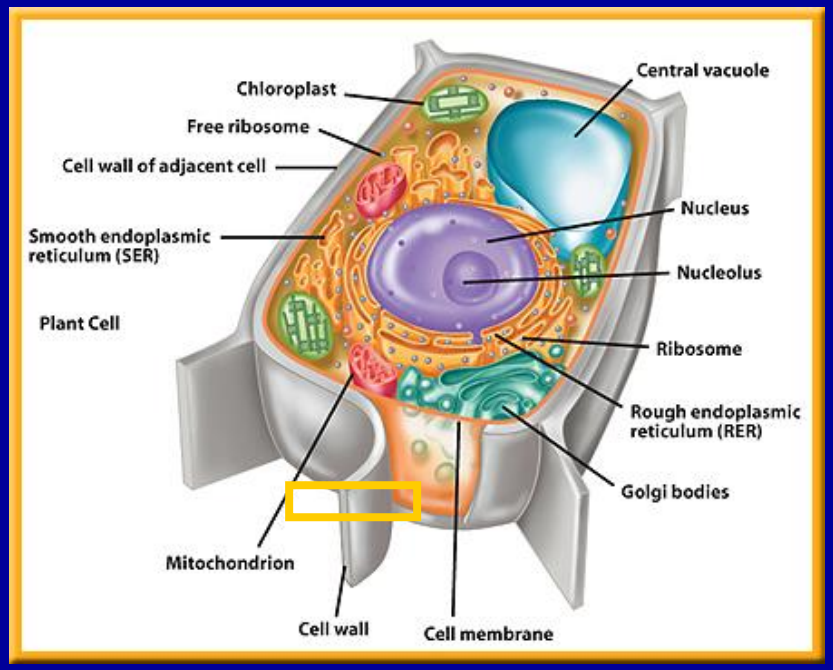
- DNA is the chemical that contains the code for cell's structure and activities.

# Nucleolus

- A structure called a nucleolus also is found in the nucleus, and is **where most ribosomes are made** in an eukaryotic cell.



# Chloroplasts and its importance




- Chloroplasts are organelles found in plant cells and **contain the green pigment chlorophyll.**

**Chlorophyll** is a pigment that **captures energy** from the Sun.

Energy from the Sun is needed for **Photosynthesis**

**During Photosynthesis – sugar molecules are formed inside the chloroplast**

# Mitochondria

- **During photosynthesis – sugars are synthetized by the plant.**
- The sugars are stored in the plant .
- When the plant needs energy, the sugar will be broken down inside the **mitochondria.**

The process of breaking down food releasing energy and oxygen is called **cellular respiration and it happens inside the mitochondrion**

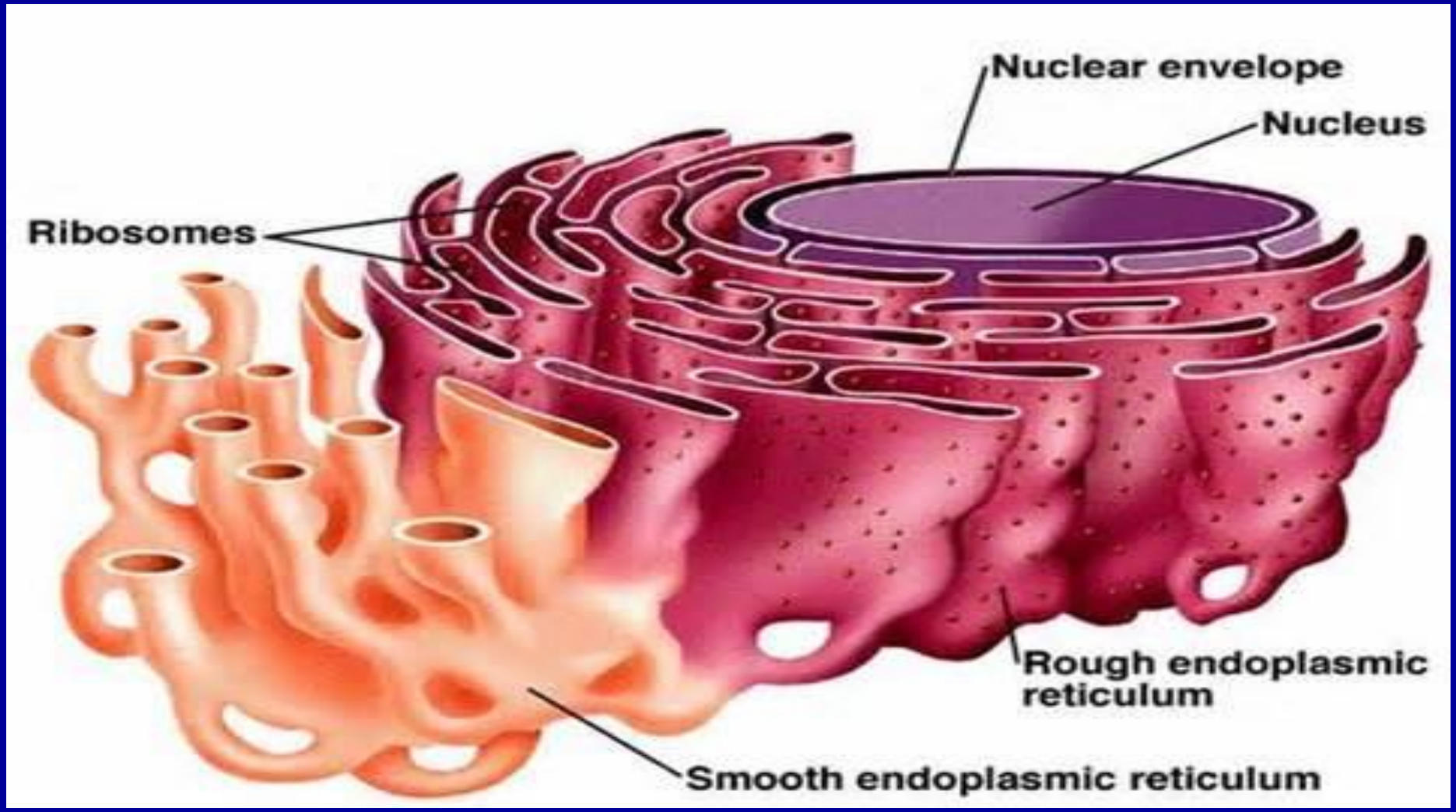
# Mitochondria and its importance

Mitochondria – plural
Mitochondrion – singular

# Endoplasmic Reticulum and its importance

A series of folded membranes in which materials can be **processed** and **moved** to other areas inside the cell.

# ER: Smooth or Rough (with attached ribosomes)



# Ribosomes and RER

- Ribosomes synthetize proteins
- The proteins are moved to different areas of the cell by the RER – **rough endoplasmic reticulum**

# Smooth ER

- processes and transports other cellular substances such as lipids
- Lipids are substances that store energy.

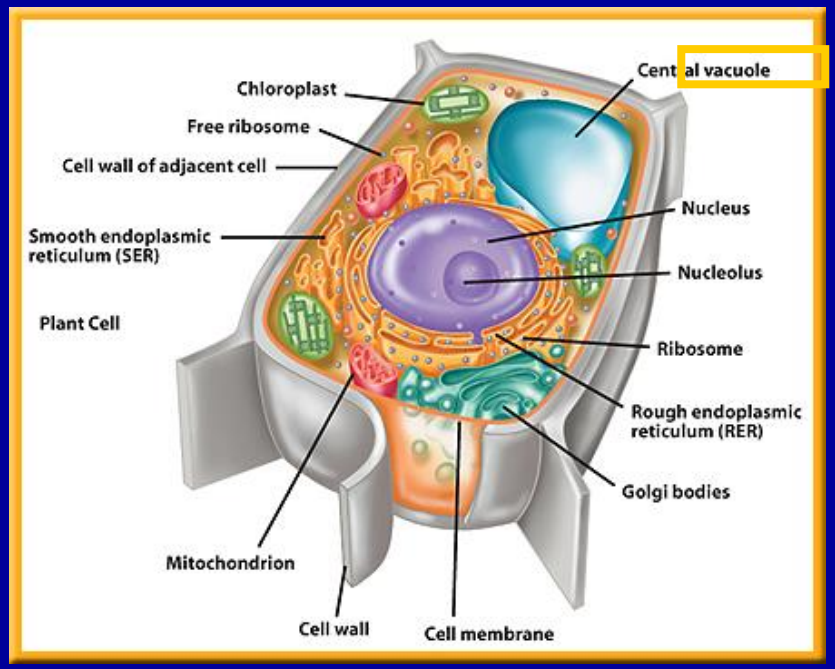
# Golgi Bodies

•The Golgi bodies are **stacked, flattened membranes.**

•**Sort and package** cellular substances into membrane-bound structures called **vesicles**, for storage or elimination. Unwanted substances are taken to the outside of the cell

# Vacuoles

- Cells also have membrane-bound spaces called vacuoles for the **temporary** storage of materials




- A **vacuole can store** water, waste products, food, and other cellular materials.

# Vacuoles

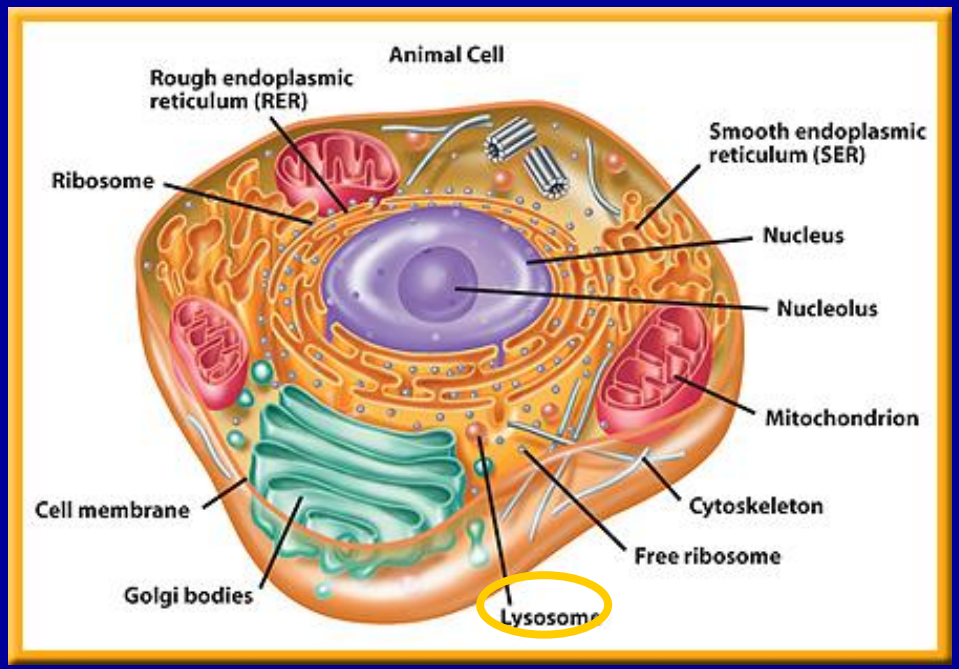
- Plant Cells – big vacuole – occupies almost all the space inside the cell
- Animal Cells have small vacuoles

  Why are they different?

*** Vacuoles in the plant cell are also responsible for the shape of the cell**

# Lysosomes

- **Lysosomes** contain digestive chemicals that help break down food molecules, cell waste, and worn-out cell parts.



# Lysosomes

**The lysosome's membrane prevents the digestive chemicals inside from leaking into the cytoplasm and destroying the cell.

**** When a cell dies, the lysosome's membrane disintegrates, releasing digestive chemicals that allow the quick breakdown of the cell's contents.**

# Lysosomes are found only in animal cells

**** There is debate about the presence of lysosomes in plant cells.**

Apparently, some vacuoles in plant cells contain some enzymes found in the lysosomes of animal cells, and are responsible for **digestion**.

# Page 225 and Figure 13 – Animal Cell

- Animal Cells have:
- **Centrioles** – involved in the process of cell division
- **Cytoskeleton** – responsible for shape and movement of some cells

- See page 243 questions 14 and maybe 15 important additions

# Differences between Plant and Animal cells

| | Plant cell | Animal cell |
|---|---|---|
| Cell Wall | Yes | No |
| Chloroplasts | Yes | No |
| Vacuoles | One Big Vacuole | Several Small Vacuoles |
| Lysosomes | ? In discussion | Yes |
| Centrioles and Cytoskeleton | No | Yes |
| Shape | Rectangular (ish) | Round (ish) |