ANATOMY

LEVEL OF STRUCTURE ORGANIZATION

KMTC VOI CAMPUS

CMS MARCH 2020 CLASS

GROUP 2

OUMA

GRACE

IRINE

EMMANUEL

LEVEL OF STRUCTURE ORGANIZATION

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CHEMICAL ELEMENTS.
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Body chemicals

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TYPE OF TISSUE
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2. CONNECTIVE
3. MUSCULAR
4. NERVOUS TISSUE

05

STRUCTURE AND
LOCATION
ORGAN SYSTEM
ORGANISM

The atom is the smallest particle of an element which can exist as a stable entity. An element is a chemical substance whose atoms are all of the same type; e.g. iron contains only iron atoms. Compounds contain more than one type of atom; for instance, water is compound containing both hydrogen and oxygen atoms(H2O). An element is a substance made of only one type of atom (therefore, an atom is the smallest part of an element). There are 92 naturally occurring elements in the world around us.
Examples are hydrogen (H), iron (Fe), oxygen (O), calcium (Ca), nitrogen (N), and carbon (C). In nature, an element does not usually exist by itself but rather combines with the atoms of other elements to form compounds.

Atomic structure

Atoms are made up of three main types of particles.
Protons are particles present in the nucleus or central part of the

Atoms are the smallest parts of an element that have the characteristics of that element. An atom consists of three major subunits or particles: protons, neutrons, and electrons. A proton has a positive electrical charge and is found in the nucleus (or center) of the atom. A neutron is electrically neutral (has no charge) and is also found in the nucleus. An electron has a negative electrical charge and is found outside the nucleus orbiting in what may be called an electron cloud or shell around the nucleus. The number of protons in an atom gives it its atomic number. Protons and neutrons have mass and weight; they give an atom its atomic weight. In an atom, the number of protons () equals the number of electrons (); therefore, an atom is electrically neutral. The electrons, however, are important in that they may enable an atom to connect, or bond, to other atoms to form molecules. A molecule is a combination of atoms (usually of more than one element) that are so tightly bound together that the molecule behaves as a single unit. Each atom is capable of bonding in only very specific ways. This capability depends on the number an the arrangement of the electrons of the atom. Electrons orbit the nucleus of an atom in shells or energy levels

The first, or innermost, energy level can contain a maximum of two electrons and is the considered stable. The second energy level is stable when it contains its maximum of eight electrons. The remaining energy levels, more distant from the nucleus, are also most stable when they contain eight electrons, or a multiple of eight. A few atoms (elements) are naturally stable, or uninterested in reacting, because their outermost energy level already contains the maximum number of electrons. The gases helium and neon are examples of these stable atoms, which do not usually react with other atoms. Most atoms are not stable, however, and tend to gain, lose, or share electrons in order to fill their outermost shell. By doing so, an atom is capable of forming one or more chemical bonds with other atoms. In this way, the atom becomes stable, because its outermost shell of electrons has been filled. It is these

The human body is a precisely structured container of chemical reactions. The body consists of trillions of atoms in specific arrangements and thousands of chemical reactions proceeding in a very orderly manner. The keys to understanding human consciousness and self awareness are still beyond our grasp. We do not yet know what enables us to study ourselves—no other animals do, as far as we know—but we have accumulated a great deal of knowledge about what we are made of and how it all works. Some of this knowledge makes up the course you are about to take, a course in basic human anatomy and physiology. Pathophysiology is the study of disorders of functioning, and a knowledge of normal physiology makes such disorders easier to understand.

Anatomy is the study of body structure, which includes size, shape, composition, and perhaps even coloration. Physiology is the study of how the body functions. The physiology of red blood cells, for example, includes what these cells do, how they do it, and how this is related to the functioning of the rest of the body. Physiology is directly related to anatomy. For example, red blood cells contain the mineral iron in molecules of the protein called hemoglobin; this is an aspect of their anatomy. The presence of iron enables red blood cells to carry oxygen, which is their function. All cells in the body must receive oxygen in order to function properly, so the physiology of red blood cells is essential to the physiology of the body as a whole.

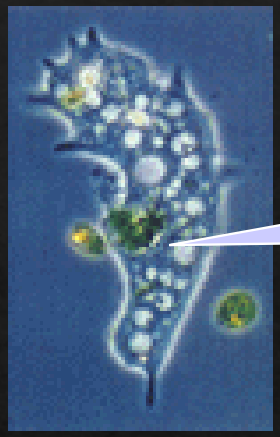
CHEMICALS

The chemicals that make up the body may be divided into two major categories: inorganic and organic. Inorganic chemicals are usually simple molecules made of one or two elements other than carbon (with a few exceptions). Examples of inorganic chemicals are water (H2O); oxygen (O2); one of the exceptions, carbon dioxide (CO2); and minerals such as iron (Fe), calcium (Ca), and sodium (Na). Organic chemicals are often very complex and always contain the elements carbon and hydrogen. In this category of organic chemicals are carbohydrates, fats, proteins, and nucleic acids.

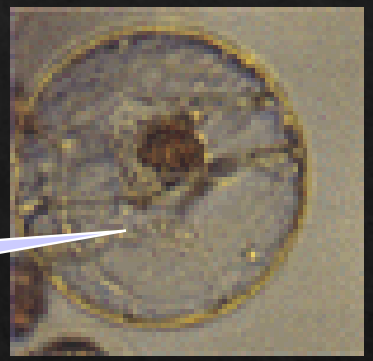
CELLULAR (CELLS) DEFINITION

Smallest living unit
Most are microscopic. A cell is the smallest unit that is capable of performing life functions.

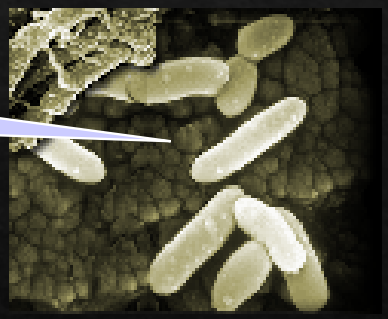
Examples of Cells



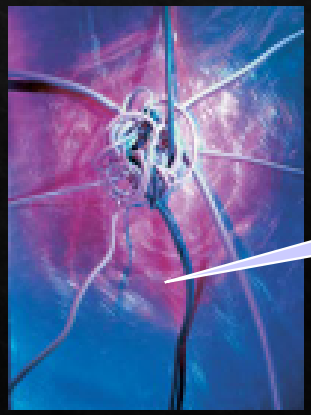
Amoeba Proteus



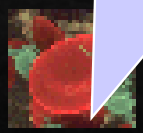
Plant Stem



Bacteria



Nerve Cell



Red Blood Cell

History of Cell Theory

i. mid 1600s – Anton van Leeuwenhoek
Improved microscope, observed many living cell
ii. mid 1600s – Robert Hooke
Observed many cells
iii. 1850 – Rudolf Virchow
Proposed that all cells come from existing cells
iv. Cells were discovered in 1665 by Robert Hooke.
v. Early studies of cells were conducted by
- Mathias Schleiden (1838)
- Theodor Schwann (1839)
vi. Schleiden and Schwann proposed the Cell Theory.

Cell Theory

1. All organisms consist of 1 or more cells.
2. Cell is the smallest unit of life.
3. All cells come from pre-existing cells.

Principles of Cell Theory

- All living things are made of cells
- Smallest living unit of structure and function of all organisms is the cell
- All cells arise from preexisting cells
- (this principle discarded the idea of spontaneous generation)
- All cells today represent a continuous line of descent from the first living cells.
- Microscopes are required to visualize cells.

i. Light microscopes can resolve structures that are 200nm apart.
ii. Electron microscopes can resolve structures that are 0.2nm apart.

Characteristics of All Cells

i. A surrounding membrane
ii. Protoplasm – cell contents in thick fluid
iii. Organelles – structures for cell function
iv. Control center with DNA

Cell Types

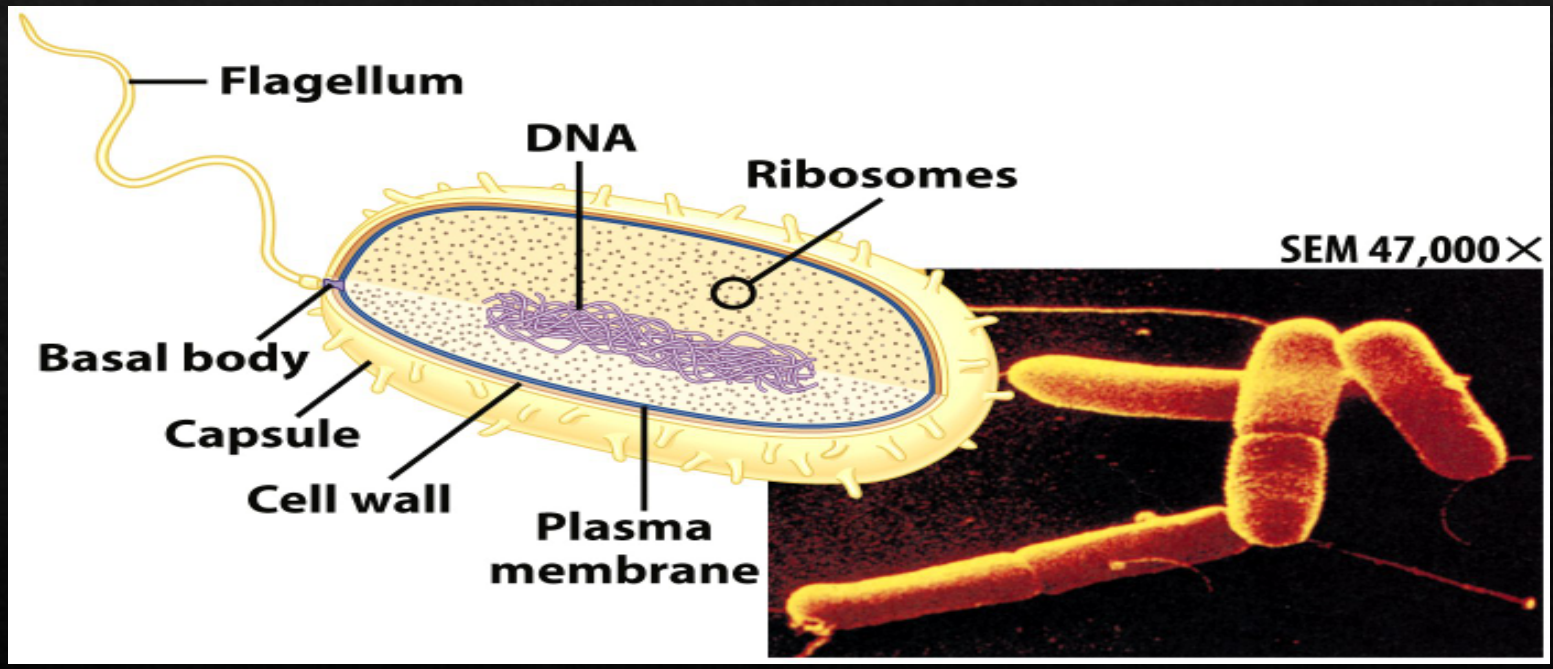
1. Prokaryotic
2. Eukaryotic

Prokaryotic

- Do not have structures surrounded by membranes
- Few internal structures
- One-celled organisms, Bacteria

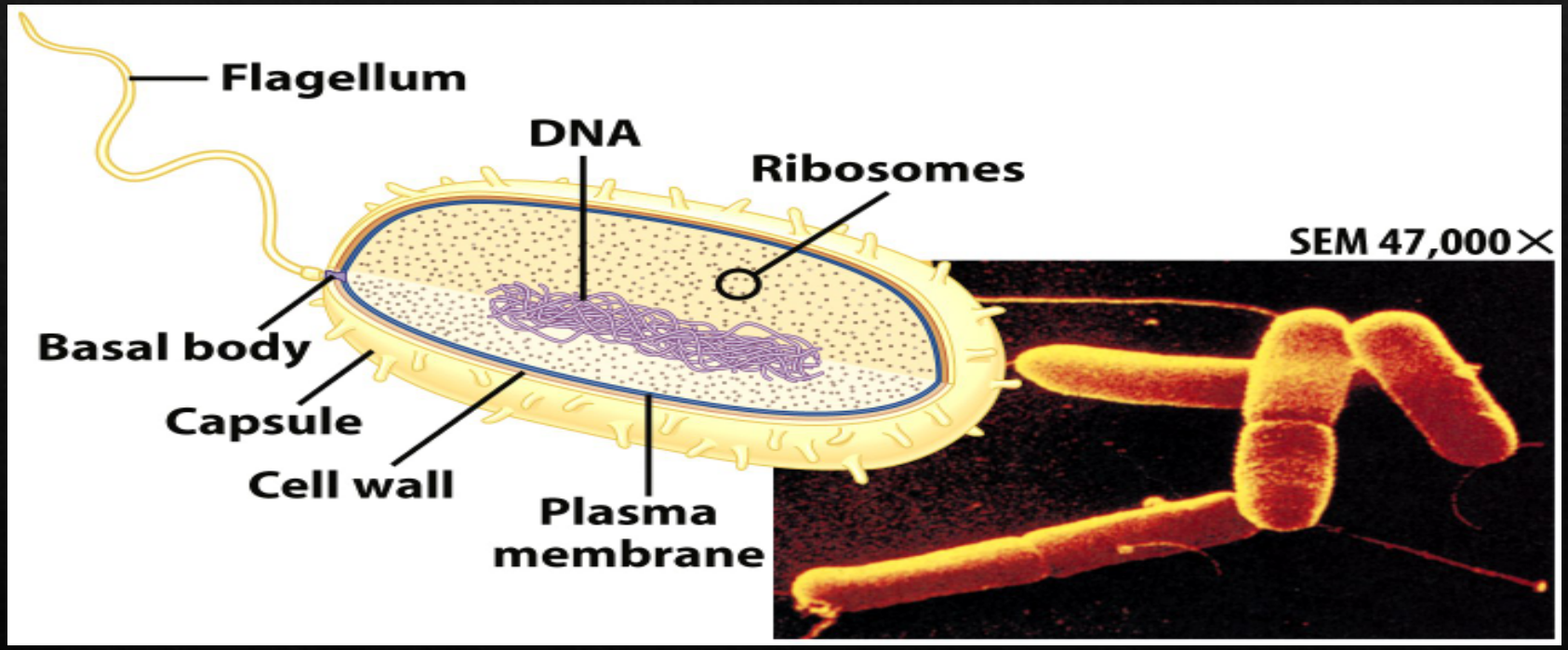
Prokaryotic Cells

- First cell type on earth
- Cell type of Bacteria and Archaea



Prokaryotic Cells

- No membrane bound nucleus
- Nucleoid = region of DNA concentration
- Organelles not bound by membranes



1. Include fungi, protists, plant, and animal cells
2. compartmentalize many cellular functions within **organelles** and the **endomembrane system i.e**

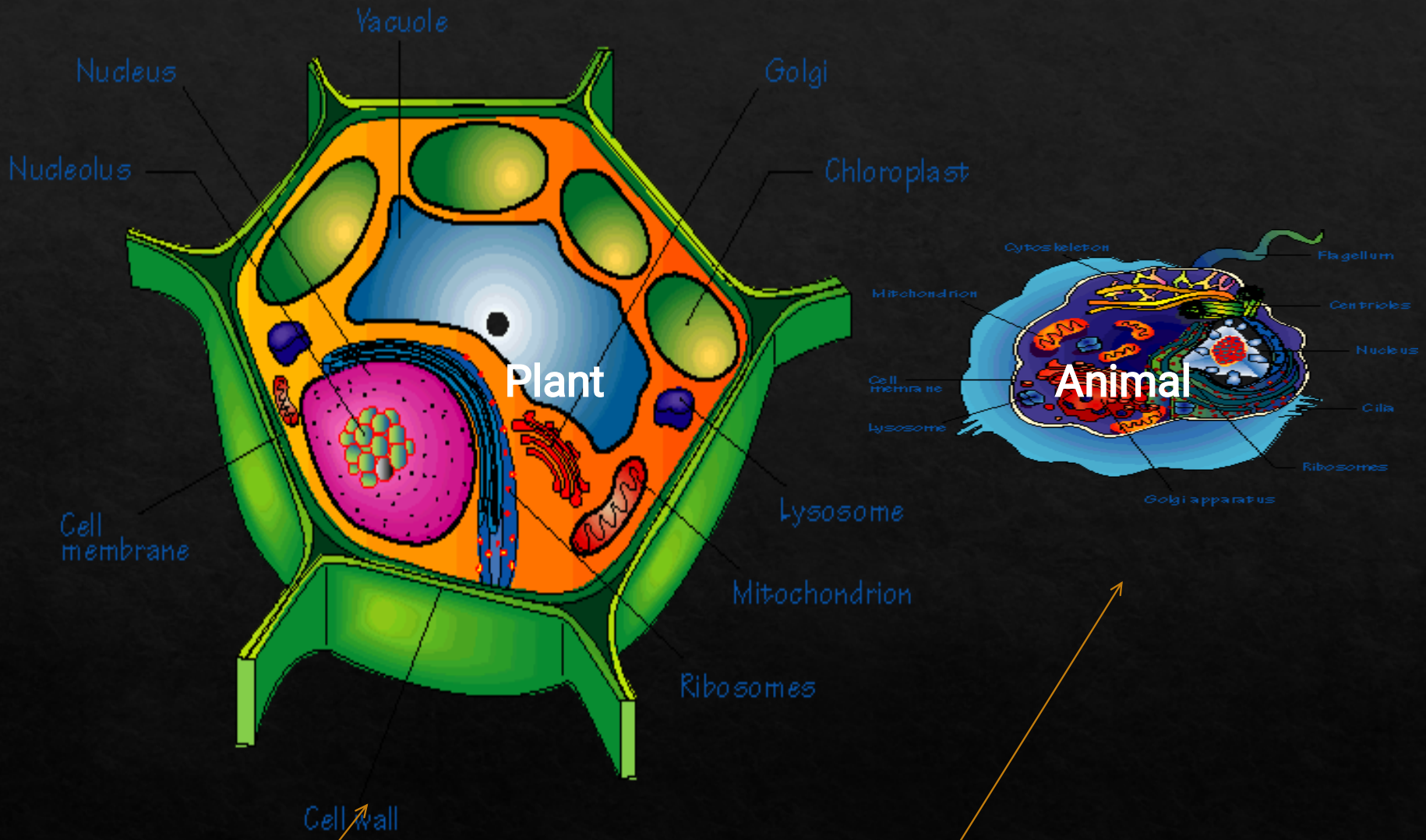
-Contain *organelles* surrounded by membranes

3 . Most living organisms

4. possess a membrane-bound nucleus

-are more complex than prokaryotic cells

5. possess a **cytoskeleton** for support and to maintain cellular structure



Plant (lt)…….. And,…….. animal (rt) cells

INTRODUCTION

- ✓The cell is the basic unit of structure and function in living things. Cells vary in their shape size, and arrangements but all cells have similar components, each with a particular function.
- ✓Some of the 100 trillion of cells make up human body.
- ✓All human cell are microscopic in size, shape and function.
- ✓The diameter range from 7.5 micrometer (RBC) to 150 mm (ovum).
- ✓Cell is defined as the fundamental living unit of any organism.
- ✓-Cell is important to produce energy for metabolism (all chemical reactions within a cell)
- ✓ -Cell can mutate (change genetically) as a result of accidental changes in its genetic material (DNA).
- ✓ Cytology: the study of the structure and functions of cells.

CELL PARTS

Organelles
=components of cell

.

cell organelles

1. Cell membrane
2. Cytoplasm
3. Nucleus
4. Mitochondria
5. Endoplasmic reticulum
6. Ribosomes
7. Lysosomes
8. Vacuoles
9. Golgi bodies
10. Chloroplast

Endomembrane System

Endomembrane system is

-a series of membranes throughout the cytoplasm

-divides cell into compartments where different cellular functions occur

1. endoplasmic reticulum
2. Golgi apparatus
3. lysosomes

Membrane Junctions

- **Tight junction** – impermeable junction that encircles the cell & prevents leakage
  - – Blood brain barrier
  - - Skin
- **Desmosome** – anchoring junction scattered along the sides of cells. Prevents tissues from fraying

Stomach, uterus , bladder

- **Gap junction** – allows chemical substances to pass between cells
- Heart

Cell structure

1) THE CELL (PLASMA) MEMBRANE

- The cell membrane is a thin, dynamic membrane that encloses the cell and controls what enters and leaves the cell.
- Fluid Mosaic Model

composed of a double layer (bilayer) of phospholipid molecules with many protein molecules dispersed within it

Fluid Mosaic Model

a. The surfaces of the membrane are "hydrophilic" due to the polar phosphate heads;

b. The internal portion of the membrane is "hydrophobic" due to the non-polar fatty acid tails;

c. The membrane proteins also have both hydrophilic and hydrophobic

d. **PLASMA MEMBRANE**

- hydrophillic phosphate head, hydrophobic fatty acid tails
- Chemical attractions are the forces that hold membranes together

Function of plasma membrane

- Serves as boundary of the cell.
- Serve as markers that identify the cells.
- Play significant role in transportation.
- Cell recognition proteins-allow cell to recognize other cells.

Membrane proteins-

- Some membrane proteins have carbohydrates attached to them, forming glycoproteins that act as identification markers
- Some membrane proteins are receptors that react to specific chemicals, sometimes permitting a process called signal transduction

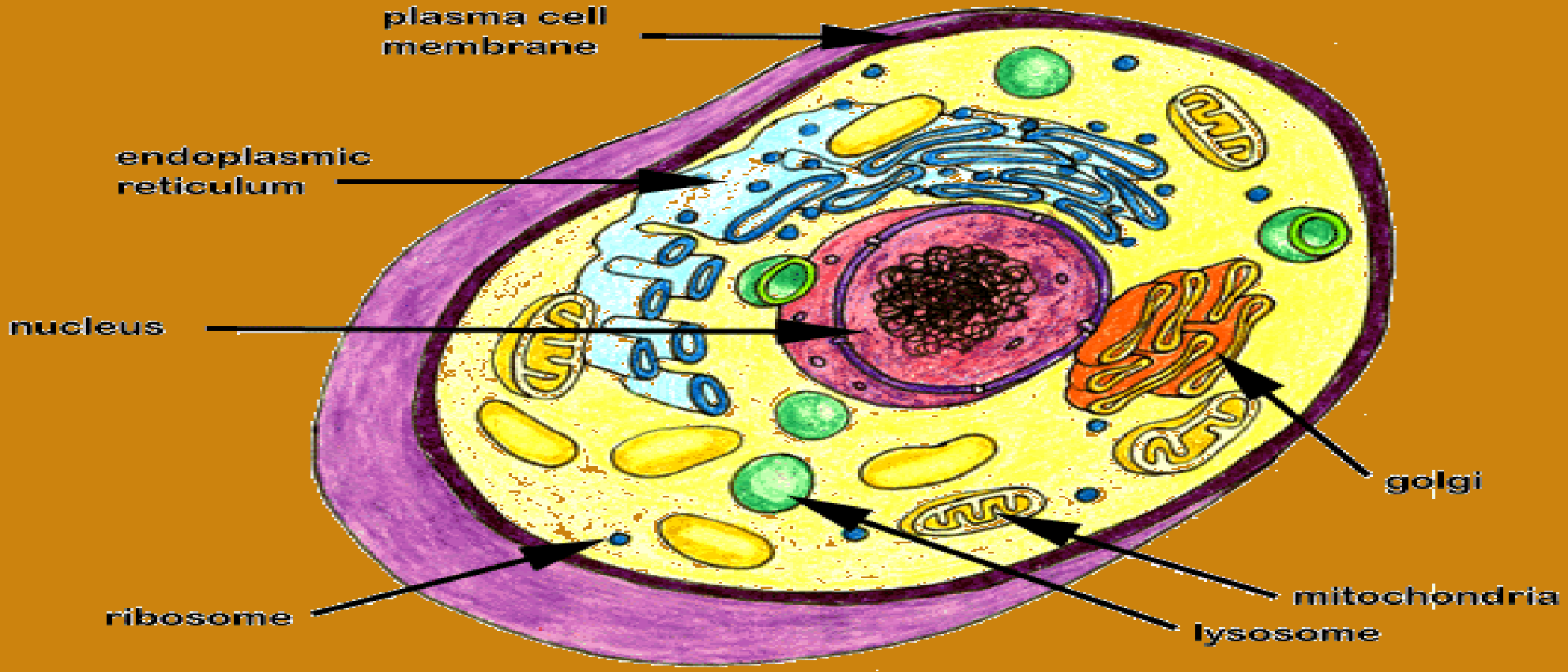
Cytoplasm

- Is a gel-like matrix of water, enzymes, nutrients, wastes, and gases and contains cell structures (organelles).
- Fluid around the organelles called cytosol.
- Most of the cells metabolic reactions occur in the cytoplasm.
- Viscous fluid containing organelles
- components of cytoplasm
  - Interconnected filaments & fibers
  - Fluid = cytosol
  - Organelles (not nucleus)
  - storage substances
  - **NB: Structures found inside the cell are called organelles.**

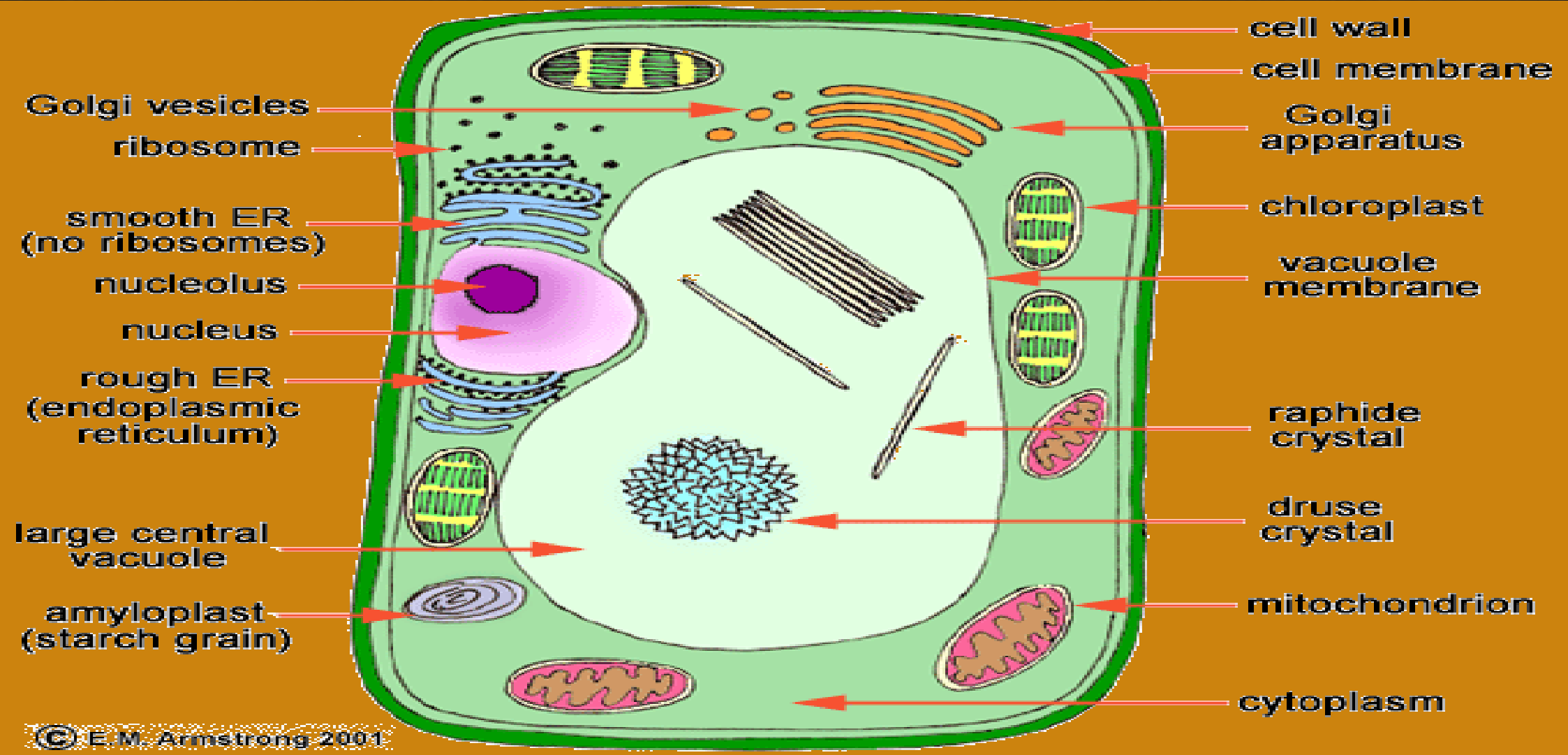
Cytoskeleton

- Filaments & fibers
- Made of 3 fiber types
  - Microfilaments
  - Microtubules
  - Intermediate filaments
- 3 functions:
  - mechanical support
  - anchor organelles
  - help move substances

“Typical” Animal Cell



“Typical” Plant Cell



Phospholipids

Interacts with water

- Polar;
  - Hydrophylic head

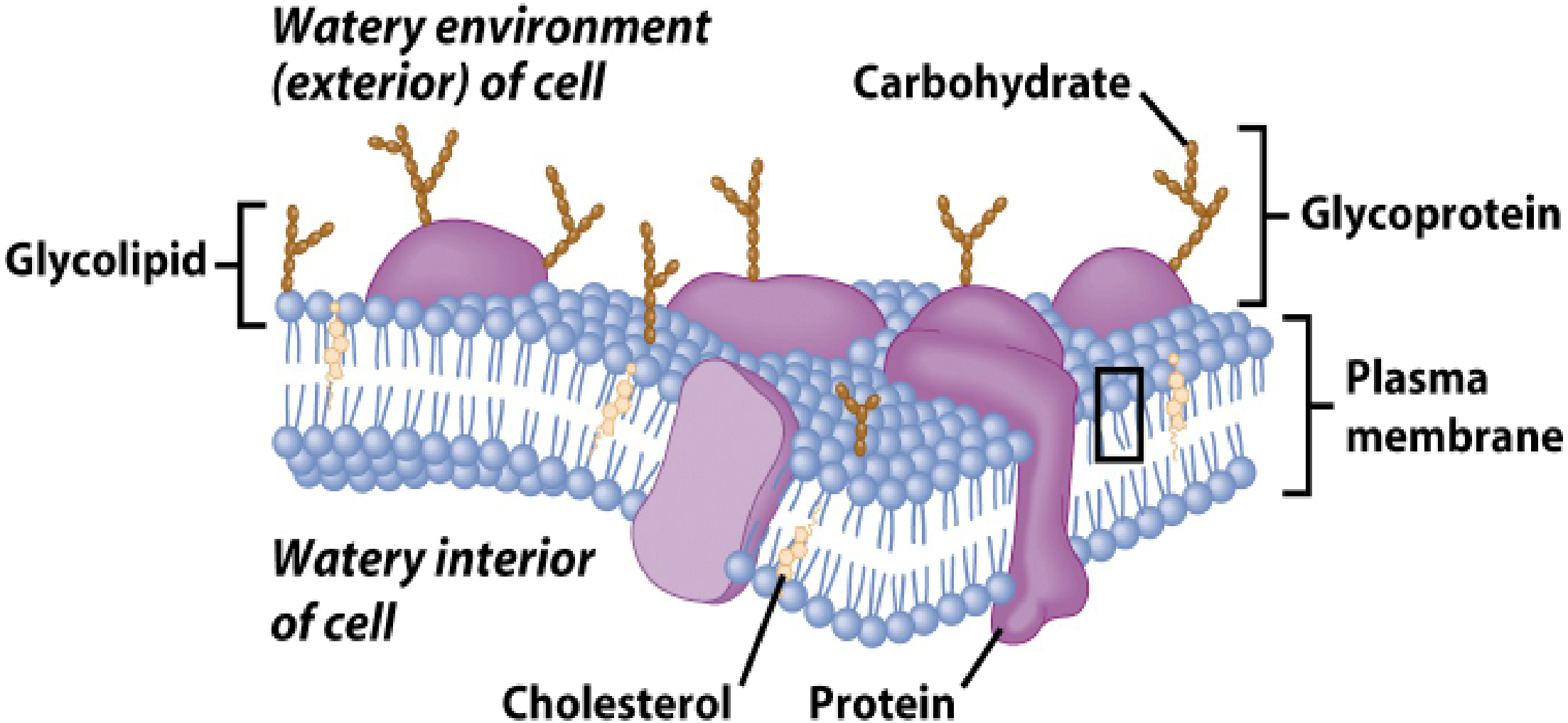
  Non polar;
  - Hydrophobic tail

Membrane Proteins

1. Channels or transporters
   - Move molecules in one direction
2. Receptors
3. Glycoproteins
   - Identify cell type
4. Enzymes
   - Catalyze production of substances

   - Recognize certain chemicals
   - (see diag. below)

Membrane Proteins



Cilia & Flagella

- Provide motility
- Cilia
  - Short
  - Used to move substances outside human cells
- Flagella
  - Whip-like extensions
  - Found on sperm cells
- Basal bodies like centrioles
- microvilli

Nucleus : enclosed by nuclear membrane

- Directs cell activities
- Separated from cytoplasm by nuclear membrane
- Contains genetic mater
- Contains:-

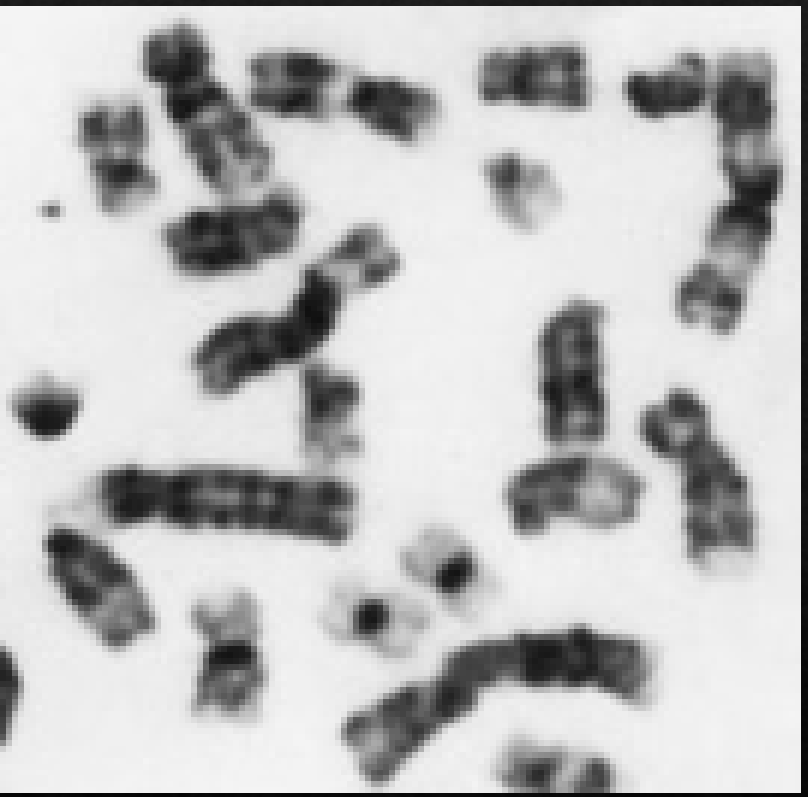
i. Hereditary material

ii. Chromosomes

  - DNA
  - Proteins
  - Form for cell division

- iii. Chromatin
- iv - DNA

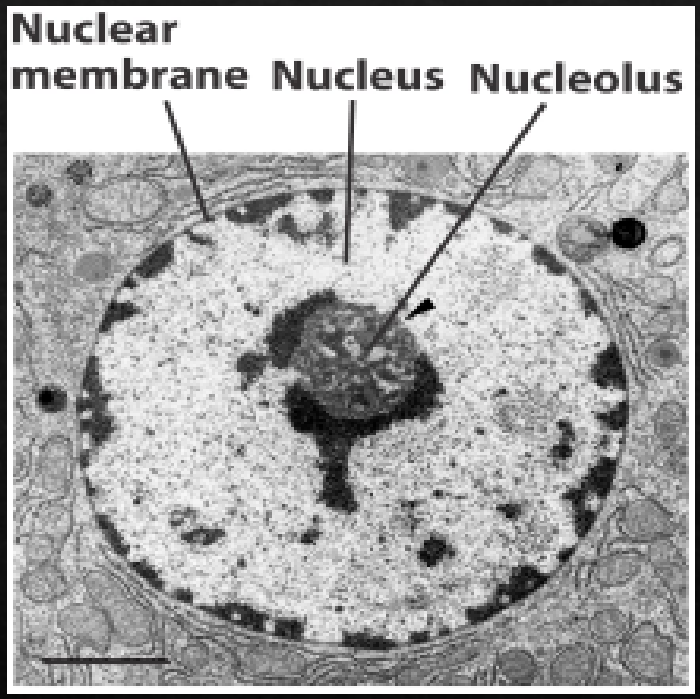
Chromosomes



- In nucleus
- Made of DNA
- Contain instructions for traits & characteristics

Nucleolus-found in the nucleus

- Most cells have 2 or more
- Directs synthesis of RNA
- Forms ribosomes



Endoplasmic Reticulum

Helps move substances within cells

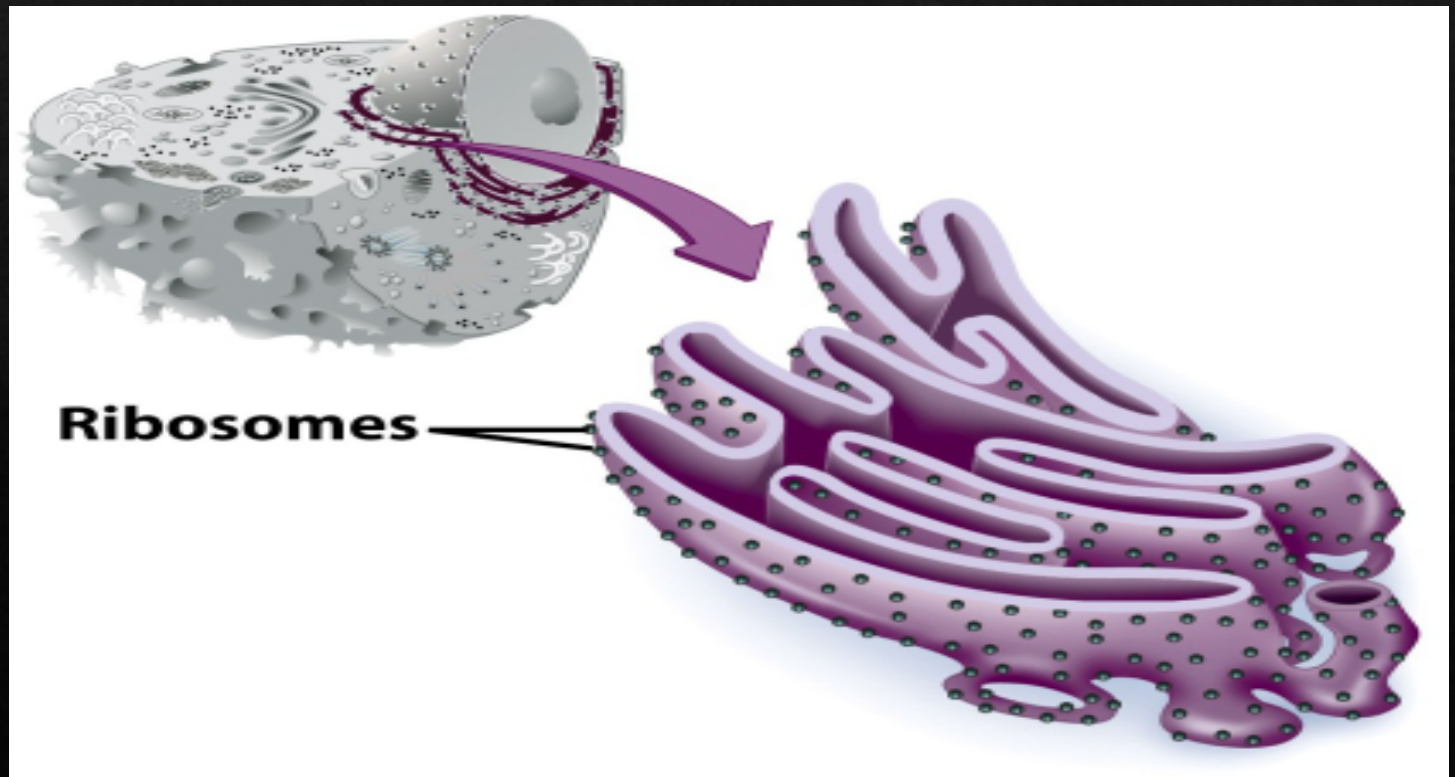
Network of interconnected membranes

Two types

- Rough endoplasmic reticulum
- Smooth endoplasmic reticulum

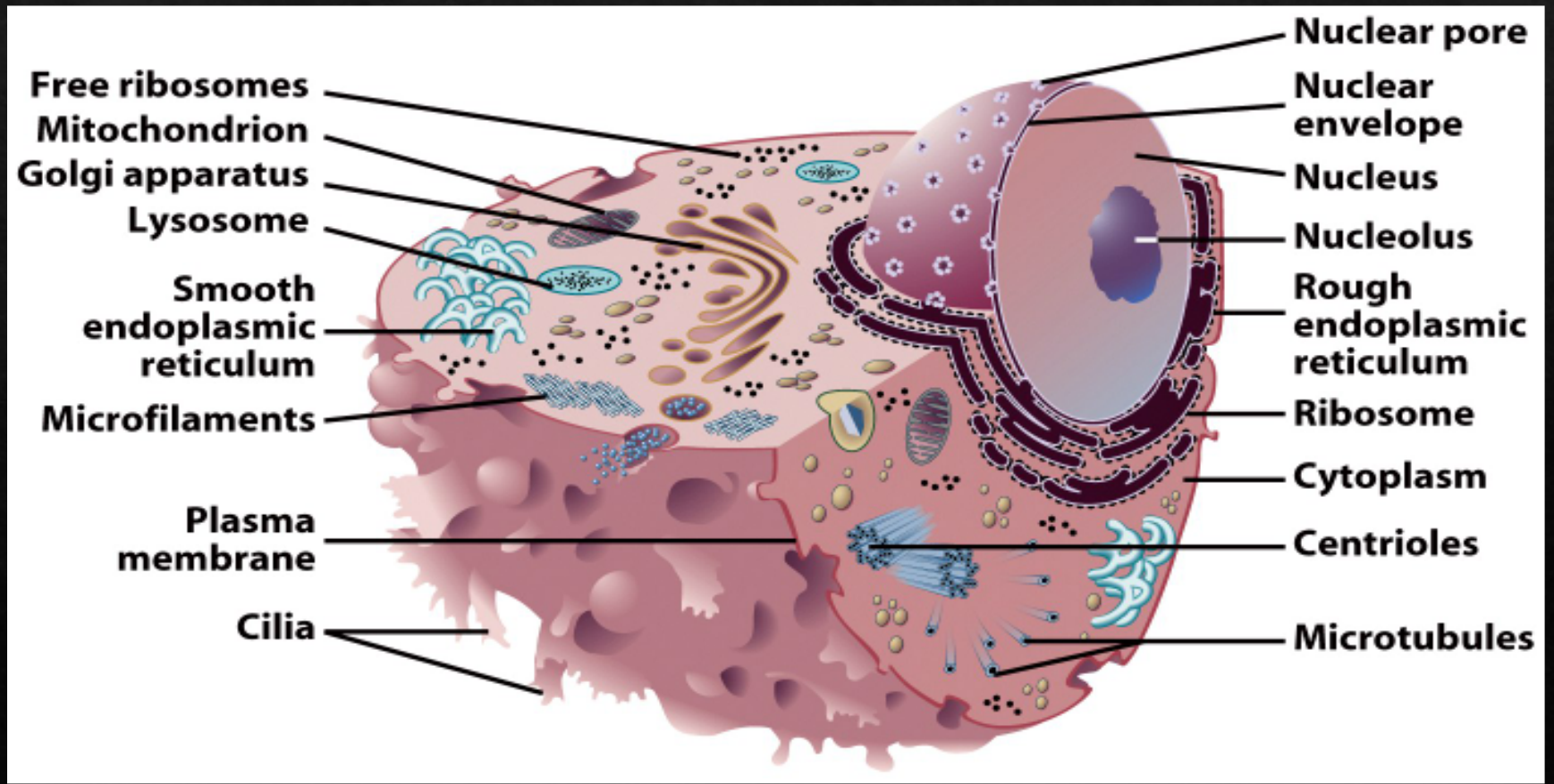
Rough Endoplasmic Reticulum

- Ribosomes attached to surface
  - Manufacture protiens
  - Not all ribosomes attached to rough ER
- May modify proteins from ribosomes



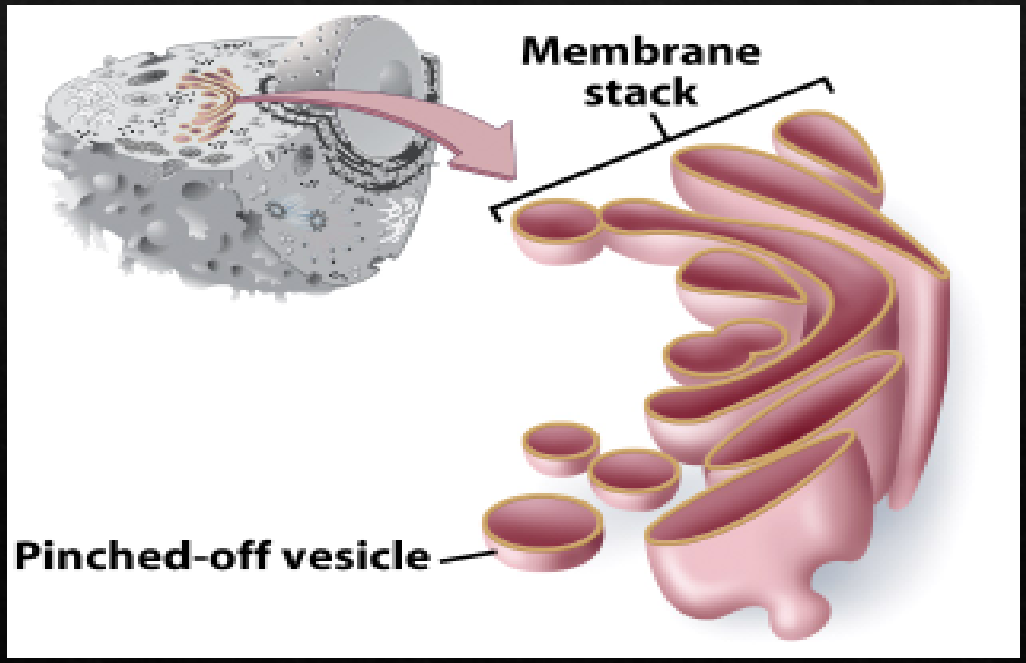
Smooth Endoplasmic Reticulum

- No attached ribosomes
- Has enzymes that help build molecules
  - Carbohydrates
  - Lipids



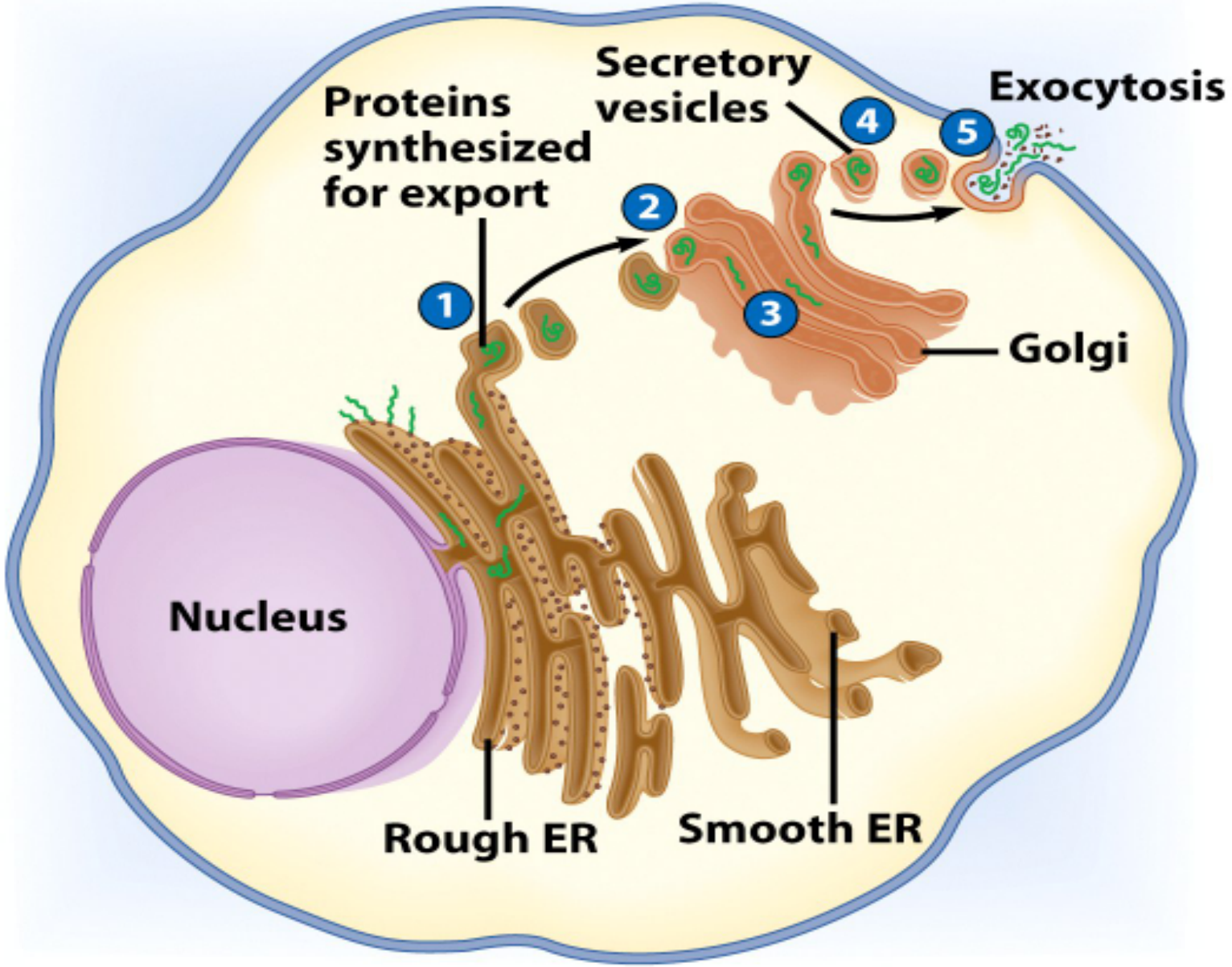
Golgi Apparatus

- Involved in synthesis of plant cell wall
- Packaging & shipping station of cell



Golgi Apparatus Function

1. Molecules come in vesicles
2. Vesicles fuse with Golgi membrane
3. Molecules may be modified by Golgi
4. Molecules pinched-off in separate vesicle
5. Vesicle leaves Golgi apparatus
6. Vesicles may combine with plasma membrane to secrete contents


Proteins synthesized for export
Secretory vesicles
Exocytosis
1
2
3
4
5
Golgi
Nucleus
Rough ER
Smooth ER

Lysosomes

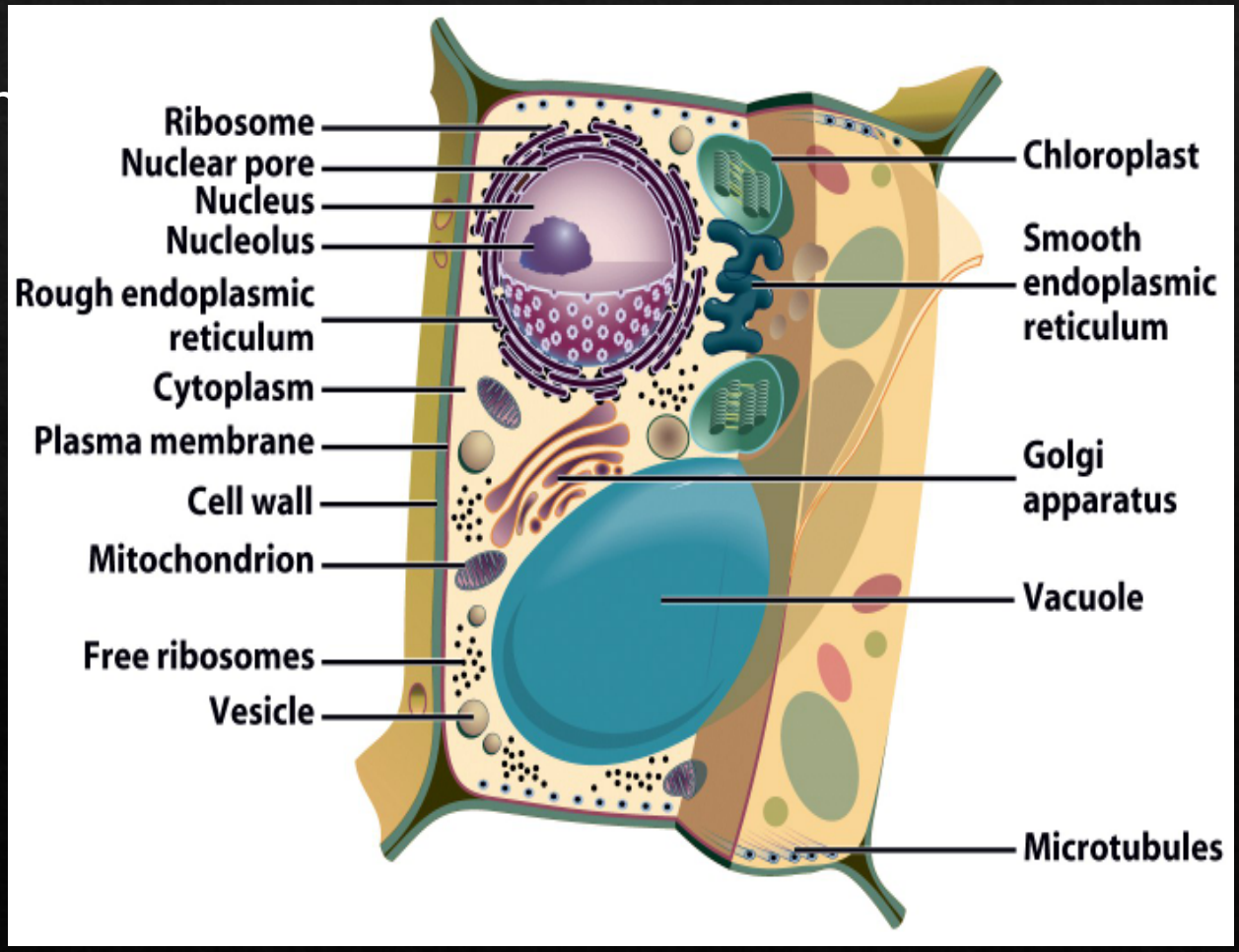
- Contain digestive enzymes
- Functions
  - Aid in cell renewal
  - Break down old cell parts
  - Digests invaders

Vacuoles

- Membrane bound storage sacs
- More common in plants than animals
- Contents
  - Water
  - Food
  - wastes

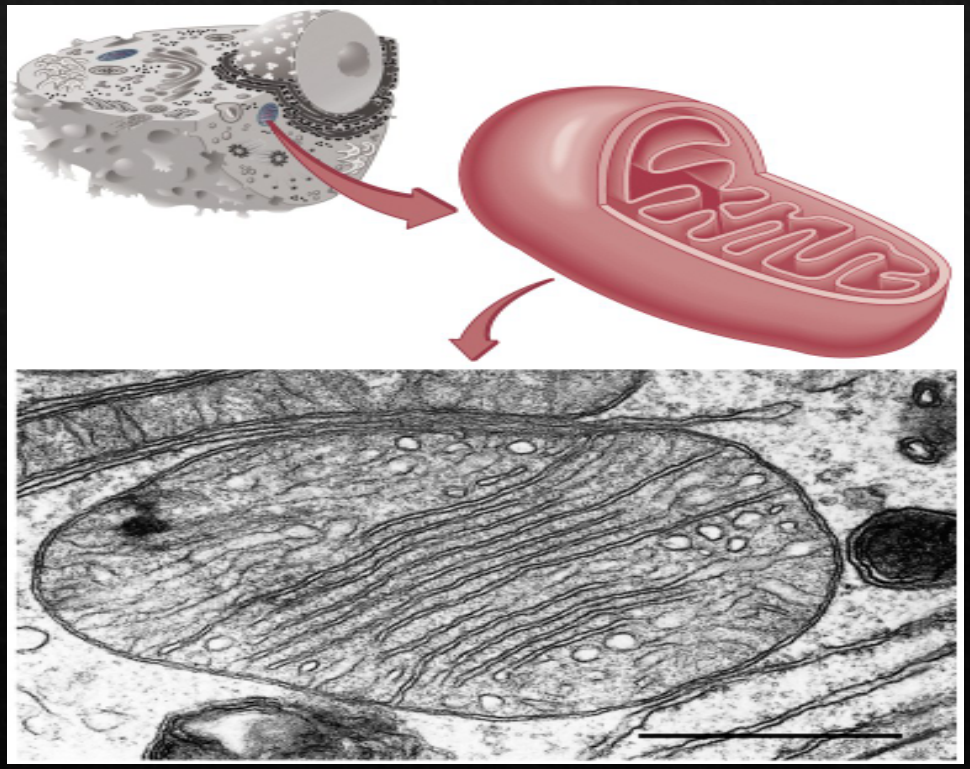
Bacteria-Like Organelles

- Release & store en
- Types
  - Mitochondria (release energy)
  - Chloroplasts (store energy)



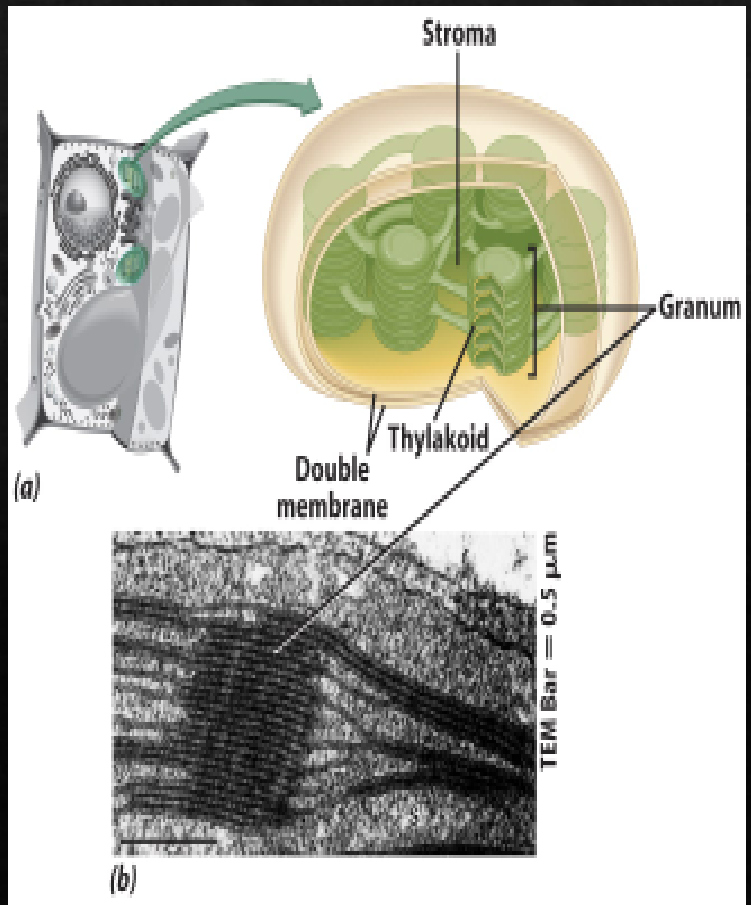
Mitochondria

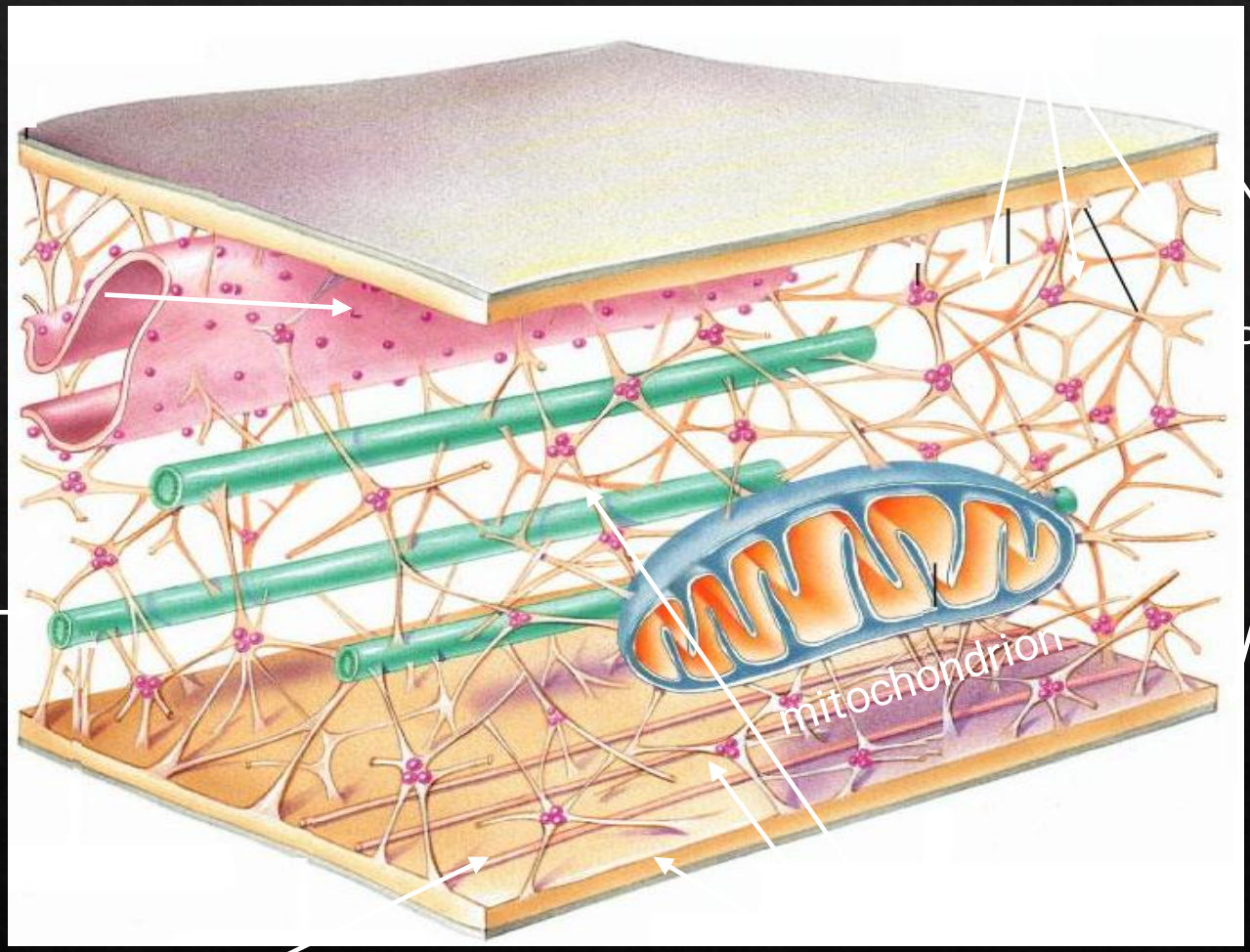
- Have their own DNA
- Bound by double membrane
- Break down fuel molecules (cellular respiration)
  - Glucose
  - Fatty acids
- Release energy
  - ATP



Chloroplasts

- Derived form photosynthetic bacteria
- Solar energy capturing organelle
  - Takes place in the chloroplast
  - Makes cellular food – glucose
  - photosynthesis
    - ➢Takes place in the chloroplast
    - ➢Makes cellular food – glucose




"free" ribosomes
ER
Plasma membrane
microtubule
mitochondrion
microfilament
Intermediate
filaments

TISSUES

Learning outcomes After studying this section you should be able to:

- describe the structure and functions of these tissues: epithelial, connective, muscle, nervous
- explain the capacity of different types of tissue to regenerate
- outline the structure and functions of membranes
- compare and contrast the structure and functions of exocrine and endocrine glands.

The tissues of the body consist of large numbers of cells and they are classified according to the size, shape and functions of these cells. There are four main types of tissue, each of which has subdivisions. They are:

- epithelial tissue or epithelium
- connective tissue
- muscle tissue
- nervous tissue

Epithelial tissue

group of tissues is found covering the body and lining cavities and tubes. It is also found in glands. The structure of epithelium is closely related to its functions which include:

- protection of underlying structures from, for example, dehydration, chemical and mechanical damage
- secretion
- absorption.

The cells are very closely packed and the intercellular substance, called the matrix, is minimal. The cells usually lie on a basement membrane, which is an inert connective tissue. Epithelial tissue may be:

- simple: a single layer of cells
- stratified: several layers of cells.

Simple epithelium

Simple epithelium consists of a single layer of identical cells and is divided into four types. It is usually found on absorptive or secretory surfaces, where the single layer enhances these processes, and not usually on surfaces subject to stress. The types are named according to the shape of the cells, which differs according to their functions. The more active the tissue, the taller are the cells.

Squamous (pavement) epithelium

This is composed of a single layer of flattened cells . The cells fit closely together like flat stones, forming a thin and very smooth membrane. Diffusion takes place freely through this thin, smooth, inactive lining of the following structures:

Heart
blood vessels
lymph vessels
alveoli of the lungs (where it is also known as endothelium)

Cuboidal (cubical) epithelium

This consists of cube-shaped cells fitting closely together lying on a basement membrane It forms the tubules of the kidneys and is found in some glands. Cuboidal epithelium is actively involved in secretion, absorption and excretion.

Columnar epithelium

This is formed by a single layer of cells, rectangular in shape, on a basement membrane. It is found lining the organs of the alimentary tract and consists of a mixture of cells; some absorb the products of digestion and others secrete mucus. Mucus is a thick sticky substance secreted by modified columnar cells called goblet cells.

Ciliated epithelium

This is formed by columnar cells each of which has many fine, hair-like processes, called cilia. The cilia consist of microtubules inside the plasma membrane that extends from the free border (luminal border) of the columnar cells. The wave-like movement of many cilia propels the contents of the tubes, which they line in one direction only. Ciliated epithelium is found lining the uterine tubes and most of the respiratory passages. In the uterine tubes the cilia propel ova towards the uterus (Ch. 19) and in the respiratory passages they propel mucus towards the throat (Ch. 10).

Stratified epithelia

Stratified epithelia consist of several layers of cells of various shapes. The superficial layers grow up from below. Basement membranes are usually absent. The main function of stratified epithelium is to protect underlying structures from mechanical wear and tear. There are two main types: stratified squamous and transitional.

Stratified squamous epithelium

This is composed of a number of layers of cells of different shapes representing newly formed and mature cells. In the deepest layers the cells are mainly columnar and, as they grow towards the surface, they become flattened and are then shed.

Non-keratinised stratified epithelium.

This is found on wet surfaces that may be subjected to wear and tear but are protected from drying, e.g. the conjunctiva of the eyes, the lining of the mouth, the pharynx, the esophagus and the vagina.

Keratinised stratified epithelium.

This is found on dry surfaces that are subjected to wear and tear, i. e. skin, hair and nails. The surface layer consists of dead epithelial cells to which the protein keratin has been added. This forms a tough, relatively waterproof protective layer that prevents drying of the underlying live cells. The surface layer of skin is rubbed off and is replaced from below.

Transitional epithelium

This is composed of several layers of pear-shaped cells and is found lining the urinary bladder. It allows for stretching as the bladder fills

To be continue... contact 0721342959 for any inquiries