IV. Cells fall into 2 major categories:

1. eukaryotes
2. prokaryotes

A. Prokaryotes are cellular organisms that don't have a "true" nucleus. They do not have a nuclear membrane. (i.e. bacteria, blue-green algae)

{Remember a nucleus is the control center of the cell. It contains the genetic material packed into chromosomes, and it is associated w/ other organelles that function in the production of amino acids and proteins based upon what the genetic material dictates.}

Prokaryotes have some genetic material, but it is not as well organized as it is in eukaryotes. Still, prokaryotes are able to reproduce.

B. Eurkaryotes are organisms that contain chromosomes including plants, animals, fungi (like mushrooms), protozoa, and most algae. Eukaryotes have the following characteristics:

1. Have a nucleus that stores their genetic material.
2. Animal cells have an organelle called a mitochondria that effectively combines oxygen and food to convert energy to a useable form.
3. Plant cells have chloroplasts, which use energy from sunlight to create food for the plant.

4. Eukaryotic cells have internal membranes, which create compartments inside the cells that have different functions.
5. Plant cells have a cell membrane and a cell wall, which is rigid; animal cells have only a cell membrane, which is soft.
6. The cytoskeleton, which reinforces the cytoplasm of the cell, controls cellular movements.

Eukaryotic cells are primarily distinguished from prokaryotic cells by having a true nucleus.

Typically eukaryotic cells are larger than prokaryotic cells.

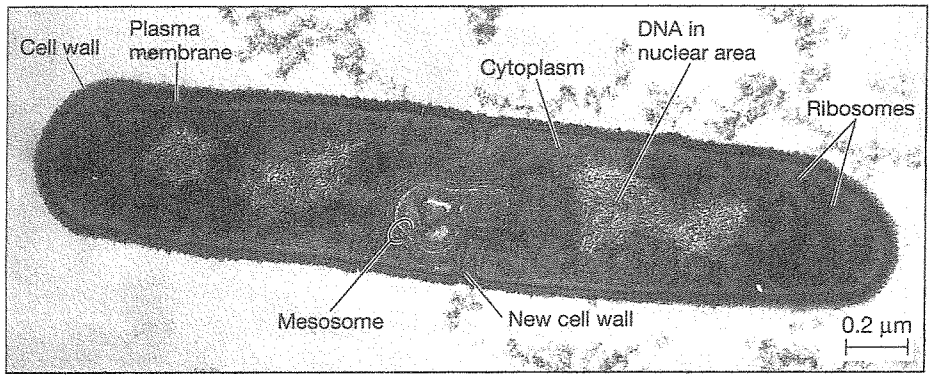
Eukaryotic cells contain many membrane-bounded organelles, prokaryotic cells do not.

Eukaryotic cells contain many internal compartments, prokaryotic cells do not.

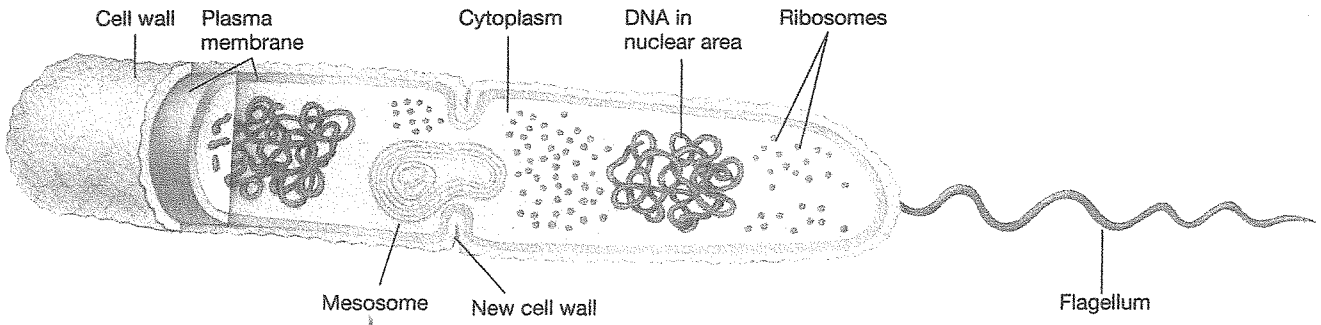
Eukaryotic cells have a membrane-surrounded nucleus, prokaryotic cells do not.

Prokaryotic DNA exists as a circular molecule and contains mesosomal spheres attached @ regular intervals along its length.

PROKARYOTIC CELL



(a) A dividing bacterial cell (TEM)



(b) Prokaryotic cell structure

in some prokaryotic cells this membrane structure has been observed to exist only as a preparation artifact, a pattern that looks like a structure but is actually produced by the process of fixing the cell for microscopy.

Animal cells have these organelles and suborganeller structures:

- centrioles
- cell membrane
- nucleus and nucleolus
- mitochondria
- Golgi apparatus
- small vacuoles
- lysosomes
- Endoplasmic reticulum
- ribosomes

Plant cells have all the organelles an animal cell has, plus

- cell wall (cellulose in cell wall provides structure and rigidity)
- Large vacuole (for storage of lg molecules of starch)
- chloroplasts, which contain chlorophyll (the green pigment in plants)

main function, make & transport proteins

Endoplasmic reticulum: series of canals that connects nucleus to cytoplasm of cell.

no ribosomes ← **smooth endoplasmic reticulum**: principle function is steroid synthesis and detoxification of harmful substances

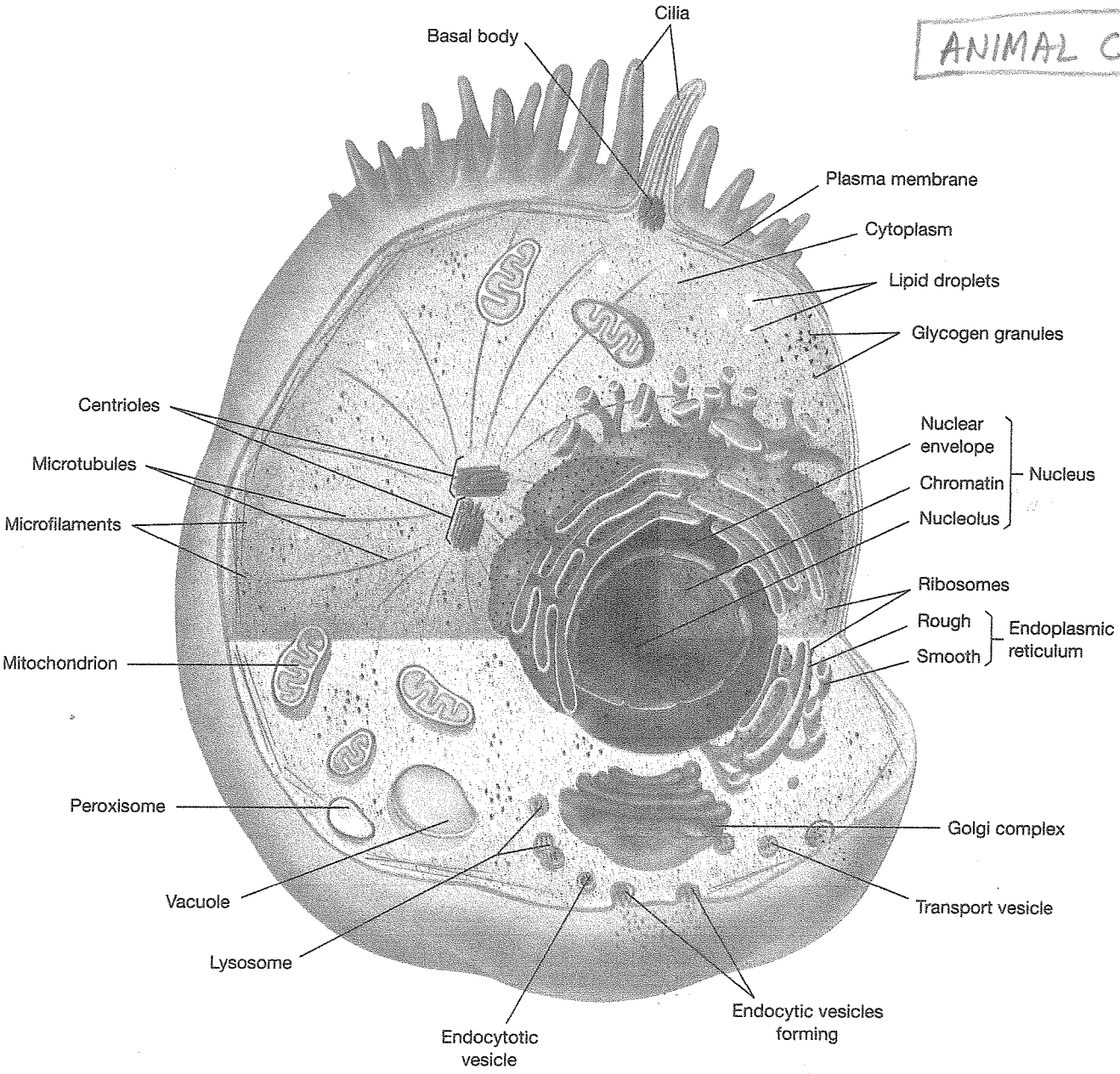
- here patches of the ER membrane bud off and form transport vehicles carrying proteins from ER lumen to Golgi complex, where the proteins are further modified then repackaged into vesicles and released by exocytosis

dotted w/ ribosomes ← **rough endoplasmic reticulum**: make proteins that will be secreted from cell

Golgi complex: consists of a stack of flattened, closed membranous sacs — it looks like a maze w/ water droplets splashing off it. the "water droplets" are transport vehicles bringing material from the ER

- Inside the Golgi apparatus, products produced by the cell (enzymes or hormones) are packaged for export to other organelles or to the outside of the cell. the Golgi apparatus surrounds the product to be secreted w/ a sac called a vesicle. Vesicle finds its way to plasma membrane, where certain proteins allow a channel to be produced so that the products inside the vesicle can be secreted outside of cell. Once outside of cell, the product (hormone or enzyme) can enter bloodstream and be transported throughout body where needed.
- So, major function is to modify, sort and package molecules such as proteins (and glycoproteins)

ANIMAL CELL



Nucleus:

Chromatin: most of genetic material in nucleus exists as a loose, indistinct tangle called by this name, when cell is not undergoing division

nuclear pores: nuclear proteins and RNA pass into and from the nucleus via these pores

Karyosome: is a dense mass of RNA and protein located w/in the nucleus

Ribosomes:

1. are sites of protein synthesis in cells
2. consist of lg and smell subunits
3. are attached to endoplasmic reticulum to form rough endoplasmic reticulum

Not in plants

← **Lysosomes**: special vesicles formed by Golgi complex to "clean up" the cell. (i.e. intracellular digestion) they are the garbage people of the cell.

- found in unicellular eukaryotic cells and animal cells
- Contain digestive enzymes used to breakdown products that may be harmful to cell and "spit" them back out into the extracellular fluid. Lysosomes also remove dead organelles by surrounding the dead organelle, breaking down its proteins and releasing them to reconstruct a new organelle.
- Because the lysosomes acts upon its own cell, process is called autodigestion

Peroxisomes: little sacs of enzymes produced by smooth ER to help protect cell from toxic products. You know how H_2O_2 when you clean a wound (kills bacteria) – well, too much inside our bodies can kill us. H_2O_2 is normally produced in some metabolic reactions, so it is inside of you. However H_2O_2 becomes harmful to the cells of the body if too much accumulates, so the key is to keep breaking it down to keep it from accumulating. Peroxisomes break down excess H_2O_2 into H_2O.

(peroxisome enzyme)

EX: the enzyme catalase is abundant in peroxisomes and uses H_2O_2 to detoxify substances especially in liver and kidneys

In some plant cells Not in animal cells

Glyoxysomes: an organelle whose major function is to convert fatty acids to carbohydrates

- are similar to peroxisomes and most common in the seedlings of plants, where they convert lipids stored in seed into carbohydrates which are used to build structures like cell walls.

Endomembrane System:

- Golgi complex
- Lysosomes
- ER
- nucleus
- nuclear pore
- vesicles
- plasma membrane

not part of system

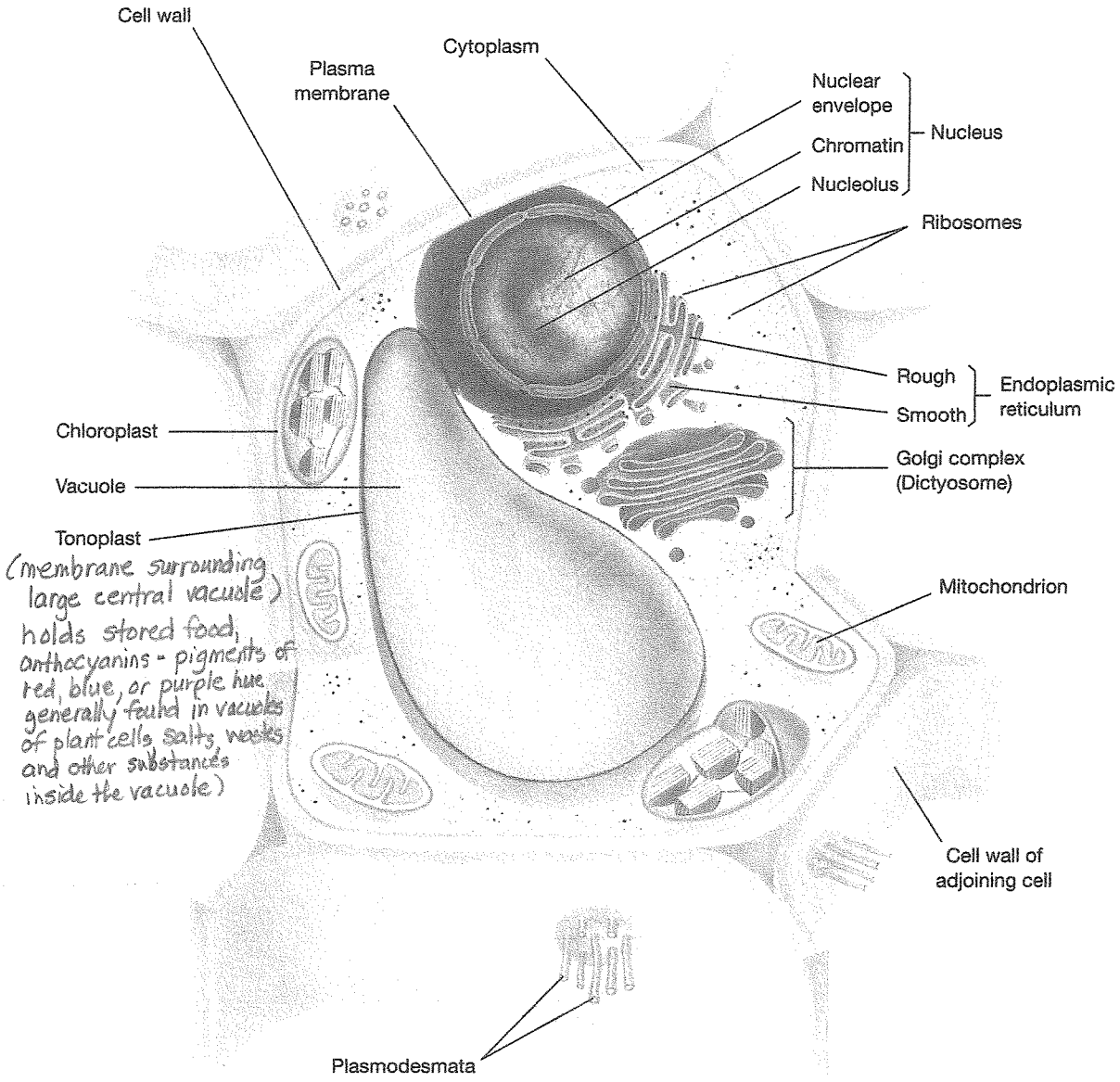
1. peroxisomes
2. glyoxysomes
3. mitochondria
4. plastids

these obtain lipid & protein molecules individually from the cytoplasm, rather than incorporating existing membranes in vesicles as other organelles do.

Mitochondria:

1. contain own DNA
2. produce some of its own lipids and proteins
3. produce most of cell's ATP

PLANT CELL



Not in animal cell ← Plastids: organelles that resemble some prokaryotic cell They (like motochondria) contain DNA, RNA, ribosomes, and they reproduce

- are found only in photosynthetic eukaryotic cells - plants and algae
- may develop into a chloroplast, chromoplast or leucoplast depending on the type of cell in which it occurs.
- chloroplasts are green plastids that carry out photosynthesis
- chromoplasts make and store yellow/orange pigments of flowers, fruits, roots
- leucoplasts are colorless pigment which serve as storage areas & classified by material stored: carbo's, fats, proteins or combos
- amyloplasts take in sugar and store it as starch ← most common leucoplast

Cell Walls: composed of cellulose and other fibers and porous to allow water and small dissolved substances through and tough enough to give the plant structure and support and flexible enough to allow plant to bend w/o breaking

- Eg plant cell builds an elastic primary cell wall
- many plants have a more rigid secondary wall when fully grown in this wall the cellulose has been reinforced by a strengthening material called lignin.

Cytoskeleton: "skeleton" of cell. It is composed of thin tubules and contractile filaments in cytoplasm

- provides framework for cell shape and movement - it seems like scaffolding - its components can be disembled, moved to new locations, and used in new structures
- made up of at least 3 types of fibers:
  1. microtubules
  2. intermediate filaments
  3. microfilaments

protein fibers that exist in muscle cells and some unicellular organisms (like amoebas)

Microtubules	Intermediate Filaments	Microfilaments
Support cellular activities	Help to maintain shape of cell	contain actin, which is involved in contraction
provide motility (ability to move)	Contributes mechanical strength	Helps unicellular organisms like amoeba change their shape; assist in both exocytosis and endocytosis.
formed from a globular protein tubulin always present in cytoplasm	Keratins (found in epithelial cells covering surface of various organs; found in epidermal cells in skin, hair, fingernails feathers)	from actin subunits found near plasma membrane; responsible for much of movement w/in a eukaryotic cell; play imp. role in cytoplasmic streaming in plant cells

Centrioles and basal bodies: they organize microtubules. Centrioles that exist in the cytoplasm outside of nuclear envelope produce microtubules. The microtubules form spindle tubules, which help cell divide during cell division. Centrioles exist typically in pairs, w/ each member located @ a right angle to the other. (see Fig 5-22 pg. 112)
Basal bodies help to form flagella and cilia

* cytoplasmic streaming: flow of cytoplasm w/in a cell or between adjacent cells via plasmodesmata.

Plant cells do not contain centrioles. Instead of having cells that provide motility, plants have hormones that cause them to move.

Tissues / Organs:

Tissues: groups of cells that perform a specific task in an organism (i.e. blood, cartilage)

Organs: groups of tissues assembled in such a way that the entire structure (organ) performs a particular function (i.e. liver, kidney, heart)

Animal Tissues: an animal's cell membrane is covered by a layer of carbohydrate, the glycocalyx, which is made up of the oligosaccharides attached to the membrane's glycoproteins and glycolipids.

, are generally divided into 4 categories:

1. epithelial tissue: forms covering and linings; these cover the outside of the body and of an internal organ; also line cavities of tubes such as digestive tract, lungs, mouth; many also secrete substances (i.e. lining of digestive tract secretes mucous)
2. connective tissue: most abundant type of animal tissue (i.e. cartilage, bone, adipose (fat) tissue); characteristically contain numerous fibers in their matrix
3. nervous tissue: nerve cells, which have the special property of irritability — ability to conduct electrical impulses in response to stimuli
4. muscle tissue: make up cells that can both conduct electrical impulses and contract

Plant Tissue: 4 main types

1. Dermal: covers the outside of the plant

   ← epidermis: 1 or 2 cells thick that cover outer surface of leaves and young stems/roots

2. Vascular: functions to transport water, nutrients (food), hormones and other substances between different parts of the plant. It makes up the veins in leaves and woods of trees.

3. Ground tissue: fills spaces between epidermis and vascular tissue inside leaves and in nonwoody stems and roots - parenchyma cells

4. Meristems: tissues made up of cells that are ready to divide & develop into the other 3 tissue types whenever plant grows new parts.