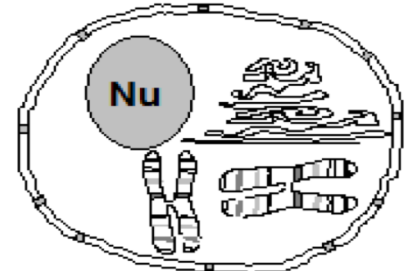


VI. Cell Structures and Their Functions

A. Nucleus

1. **Large, centrally** located
2. Surrounded by a **double** layer membrane with **pores** for selective intake and release of molecules - a **nuclear envelope**
3. Contains:
 - a. **Nucleoplasm**
 - b. **Chromosomes**
 - i. Contain DNA and organizer proteins (**histones**) densely coiled together
 - ii. Only **visible** near the time of cell division, when condensed for "**transport**"; otherwise it is called **chromatin**
 - iii. Contains all the **genetic code** for the organism

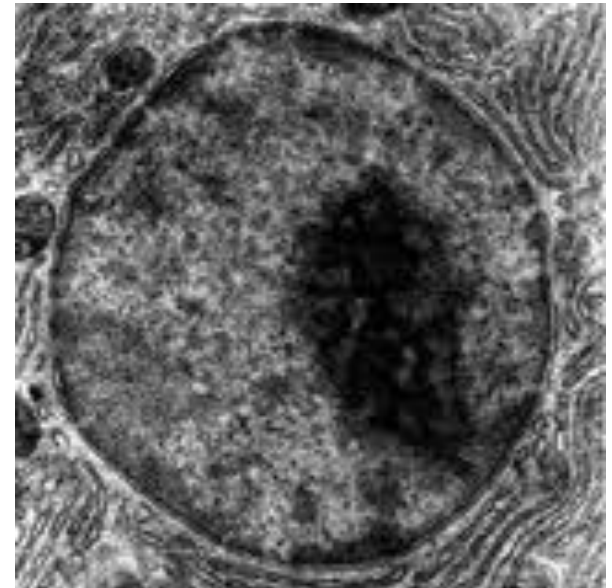


Nucleus Cont'd

C. Nucleolus

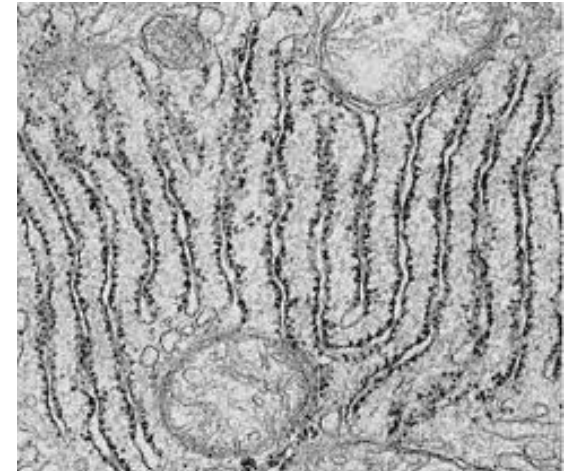
- i. **Dark-staining** areas in the nucleus (usually spherical)
- ii. Contain genetic material for making a form of **RNA** called **ribosomal RNA (rRNA)**
- iii. rRNA travels to the **cytoplasm**, where it forms the sub-units of the **ribosomes**

4. Function: **Transcription** (reading) and **replication** (duplicating) of the genetic code occurs here



Ribosomes

1. Small dense-staining **granules**
2. Composed of **rRNA** and some **proteins** that are joined prior to migration to the ER
3. Found on surface of **ER** (for producing proteins to be exported out of cell)
4. Also found free-floating in cytoplasm in small groups called **poly(ribo)somes**
 - a. polysomes produce **proteins** to be used **inside** the cell.
5. Function: Involved in **protein synthesis** (ensure correct amino acids and makes peptide bonds)



Endoplasmic Reticulum

- [ANIMATION](#)

C. Rough ER (Endoplasmic Reticulum)

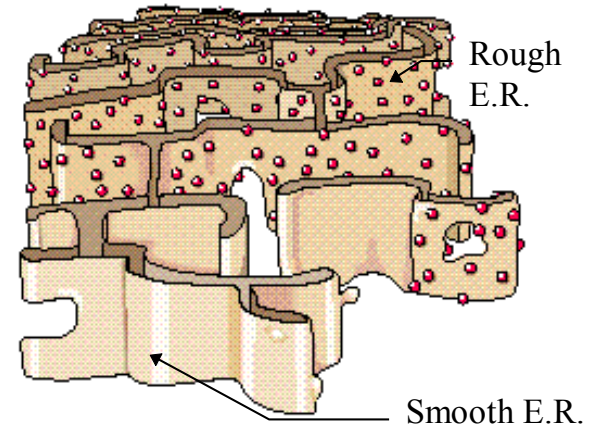
1. Series of **tubular canals** connected in places with nuclear membrane

2. Covered with ribosomes

a. **Ribosomes** produce proteins to be exported

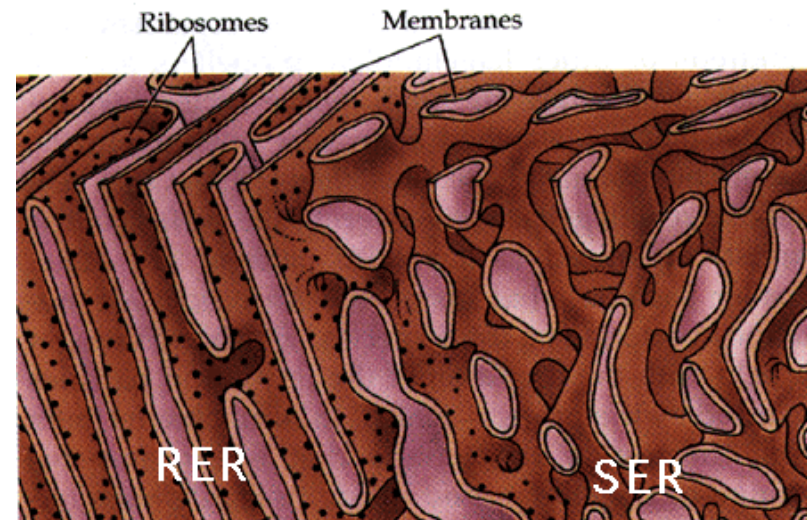
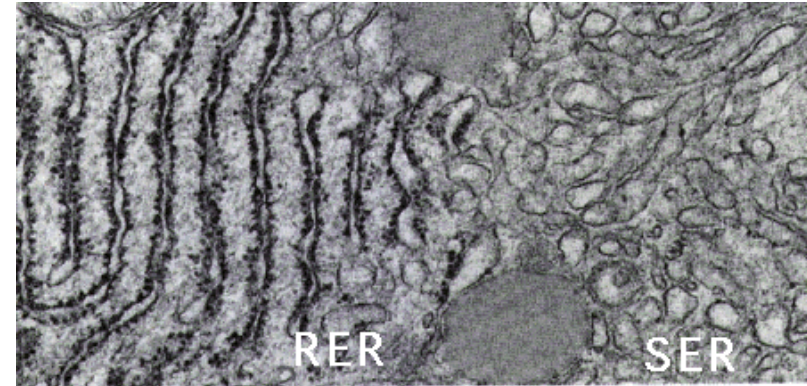
b. Proteins move inside to the **lumen** of the E.R. , then on to the **Golgi apparatus**

3. Function: **Produces/modifies** proteins to be exported by the cell

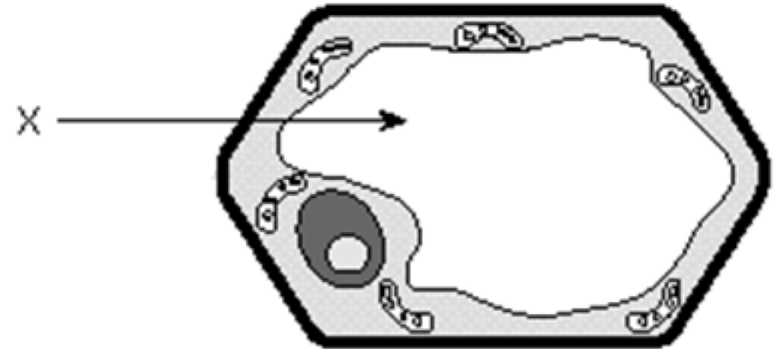


D. Smooth ER

1. Similar in structure to rough ER except **no ribosomes** on surface
2. Associated with **lipid** and **steroid** production [abundant in organs that produce steroid hormones (ovaries, testes, adrenal cortex)]

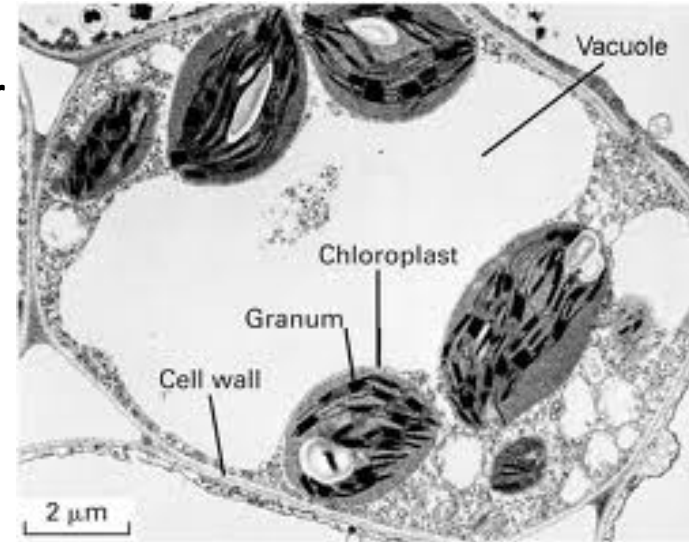


E. Vacuoles



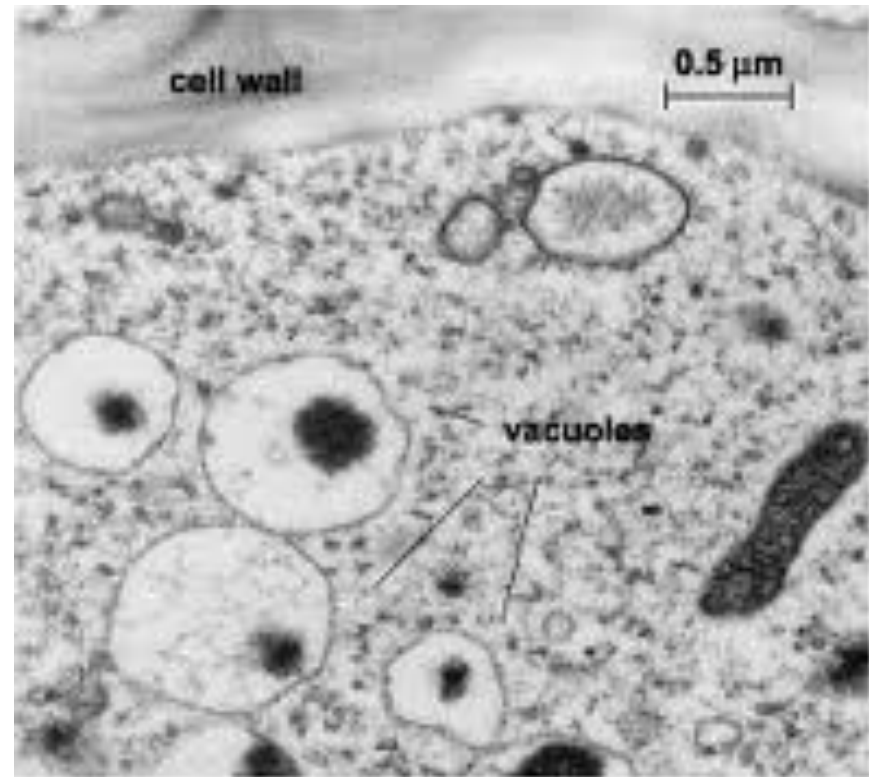
1. Non-living, and much **larger** in **plant** cells
2. Membrane-covered sack usually filled with **water** and **waste** chemicals
3. Small vacuoles are called **vesicles**

4. Function in plant cells:
- a. Have **one** large central vacuole that may occupy **90%** of the cell volume
 - b. Give **rigidity** to the cell (“**pressurized**”)
 - c. Makes the cytoplasm into a thin layer against the cell membrane to allow for better **gas exchange**
 - d. Storage of **waste** products of metabolism



5. Function in animal cells:

- a. **Digestion** of food
(e.g. food vacuoles in *Amoeba*)
- b. Elimination of excess **water**
(e.g. contractile vacuole in *Paramecium*)



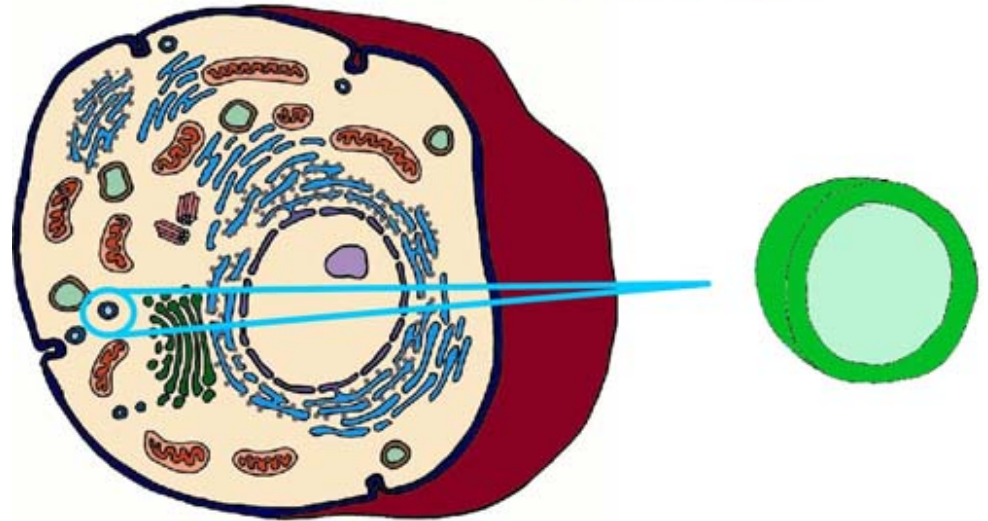
Vesicle

F. Vesicle

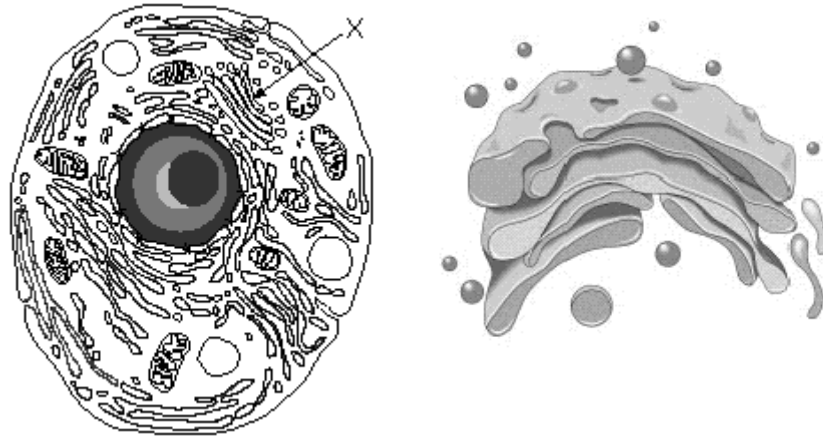
1. A small **vacuole**

2. Often used to move certain compounds require separation from the cytoplasm

(e.g. “bleb” off the Golgi, or are formed by infoldings of cell membrane)



G. Golgi Body (Golgi Apparatus)



1. Looks like a series of flattened **pancakes**
2. Materials which are produced elsewhere in the cell (esp. **E.R.**) are temporarily **stored** here
3. Materials are packaged into **vesicles**
which pinch off from the edges
 - a. These vesicles are **distributed** within the cell or are **shipped** to the cell membrane for excretion

H. Lysosomes

1. Membrane-covered vesicles of **hydrolytic enzymes** which move throughout the cell
2. Produced by the **Golgi**
3. Functions:
 - a. Attach to food vacuoles and **digest** contents
 - b. **Destroy** old or malfunctioning cell parts
 - c. **Destroy** the cell itself if the **cell becomes damaged or malfunctions**

I. Mitochondria



1. **Double** membraned structure where the inner membrane is highly infolded into **cristae** to increase inner surface area

a. **Cristae** : where enzymes are arranged in order to carry out certain reactions

2. Found in both **plant** and **animals** cells
3. Have own **DNA** (endosymbiont hypothesis)
4. Function:
 - a. Convert **food** energy to a form of energy which can be used by the cell (this energy is in the form of **ATP: adenosine triphosphate**)
 - b. Process: cellular respiration
Glucose + O₂ → CO₂ + H₂O + ATP energy
 - c. The more **active** a cell is, the more mitochondria it will have (e.g. muscle & sperm cells)

[Clip: powering the cell](#)

J. Plastids

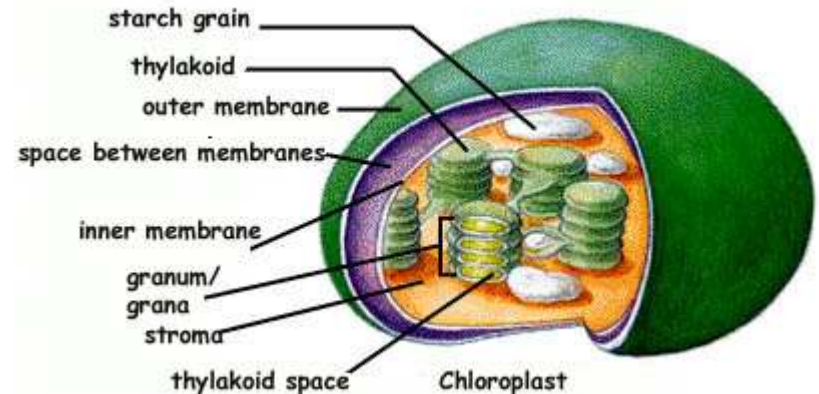
- Found only in **plant** cells
- **3** types of plastids:

a. **Chloroplasts** - most common

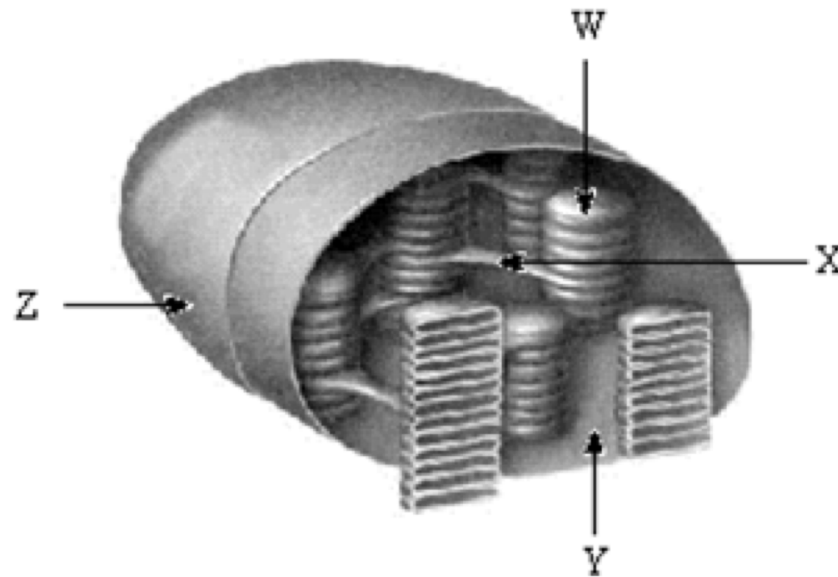
Structure:

i. Have “coin-like” membrane sacks (**thylakoids**) arranged in “stacks” called **grana** that are joined together by **lamellae** (membranes between stacks)

ii. The inner portion of the chloroplast is called the **stroma**



- b. Contain **chlorophyll** (in grana)
Site of photosynthesis
(**H₂O** + **CO₂** → **sugar** + **O₂**)





b. Chromoplasts

- i. Stores **pigments** other than **chlorophyll** (e.g. carotene, xanthophylls) that make carrots, peaches, autumn leaves, etc. yellow & orange)

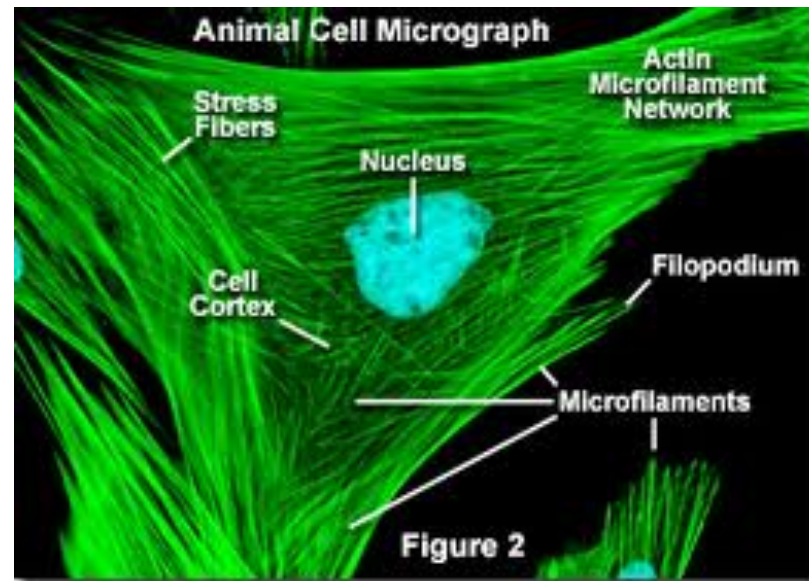
c. Leucoplast

- i. Stores **starch** (e.g. in potatoes)

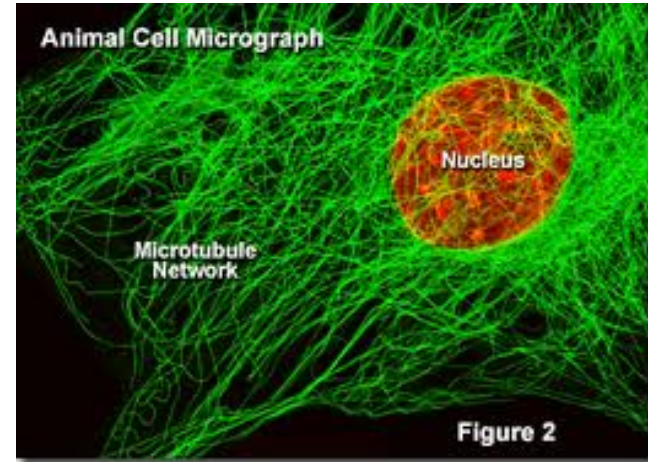


K. Microfilaments

1. **Thin solid** fibers of protein – similar to proteins in muscle fiber
2. Provide skeletal framework for the cell (**cytoskeleton**)



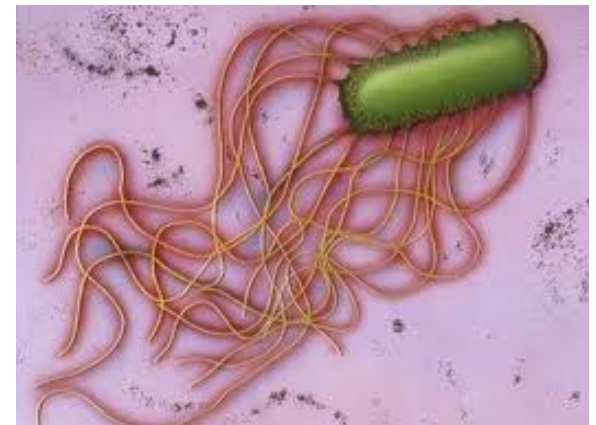
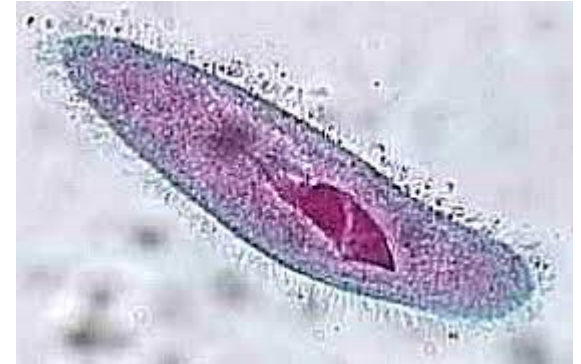
L. Microtubules



1. Larger than **microfilaments**
2. Proteins called **tubulin** are coiled in a cylindrical fashion (think Slinky) around a central **lumen**
3. Found in **cilia**, **flagella** and **centrioles**
4. Provide skeletal framework for the cell (**cytoskeleton**)

M. Cilia and Flagella

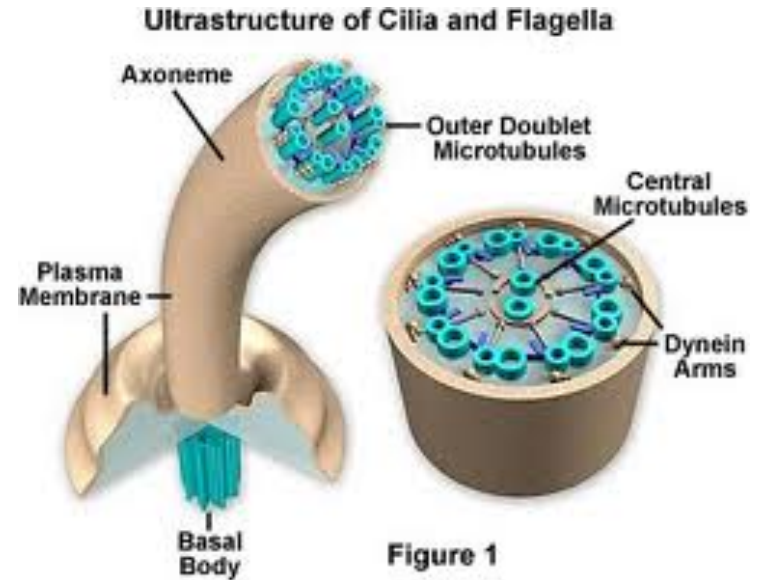
1. Hairlike projections of the cell
 - a. **cilia** - short and many
 - b. **flagella** - **long and few**
2. **Composed** of protein fibres that are able to contract and cause the cilia or flagella to beat or wave back and forth
3. For cell **locomotion**, or generating **current**



4. Inside (cross-section):

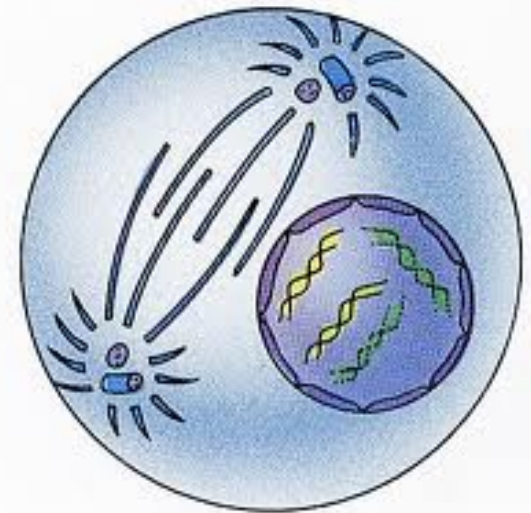
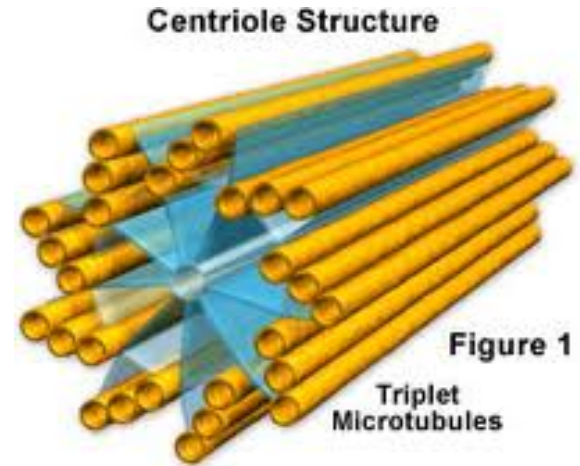
a. A "9 + 2" arrangement of microtubules

b. Except: in their basal body (anchor in cytoplasm) where the two central tubules are gone (a "9 + 0" pattern)



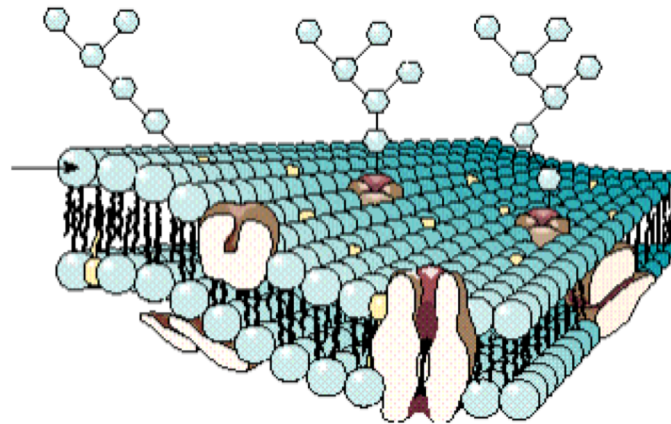
N. Centrioles

1. Are short cylinders with a “9+0” pattern
2. Produce the basal bodies of **cilia** and **flagella**
3. Probably involved in some way with the formation of **spindle fibres** in the **mitotic** process
4. Usually **2** centrioles lie on either side of the nucleus (during times of nuclear division)
5. Found in all **animal** cells



O. Cell Membrane

1. The cell membrane functions in **transport** of materials in and out of cell, **recognition**, **communication**, and **homeostasis**



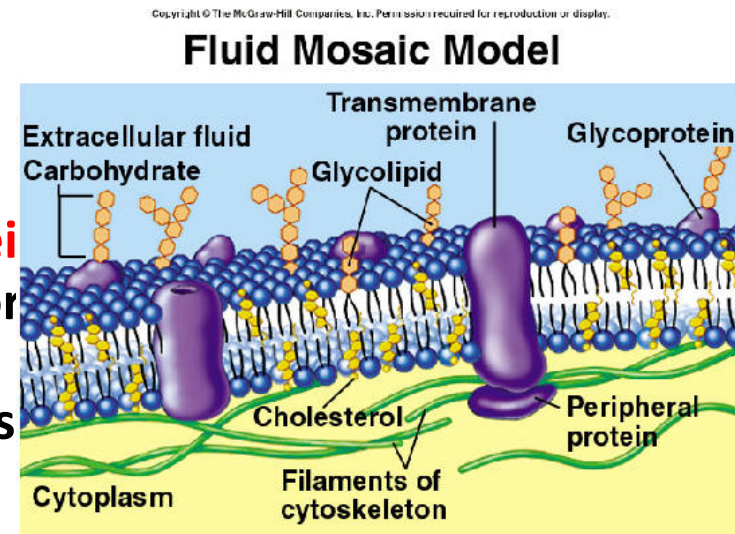
Please Label this Diagram

2. The Fluid Mosaic Model:

a. Cells are surrounded by a thin membrane of **lipid** and **protein**, about 100 angstroms (100×10^{-10} m) thick.

b. The cell membrane is a remarkable structure that has properties of a **solid** and a **liquid**.

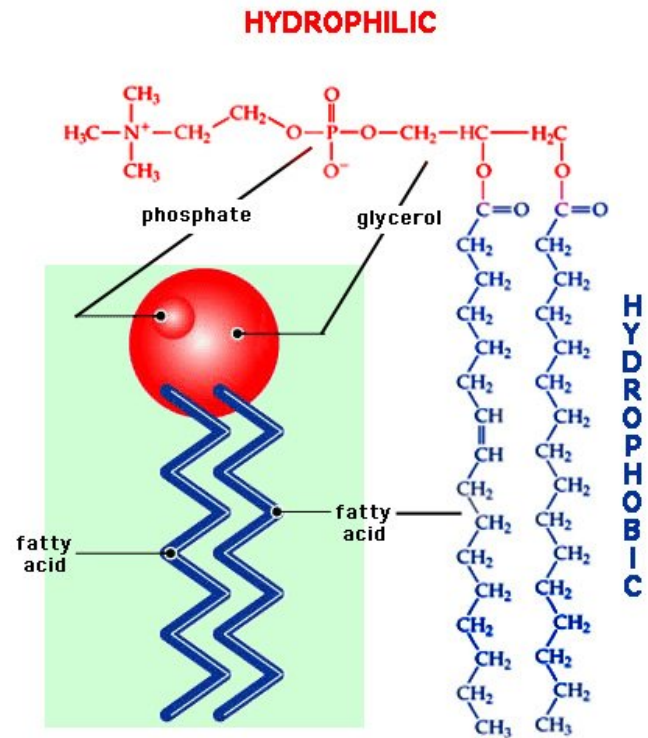
c. It forms a "fluid sea" in which **proteins** and other molecules like other **lipids** or **carbohydrates** are suspended (like icebergs) or anchored at various points its surface.



d. The “sea” or “fluid” part is composed of side by side phospholipids arranged in a bilayer (called a **lipid bilayer**).

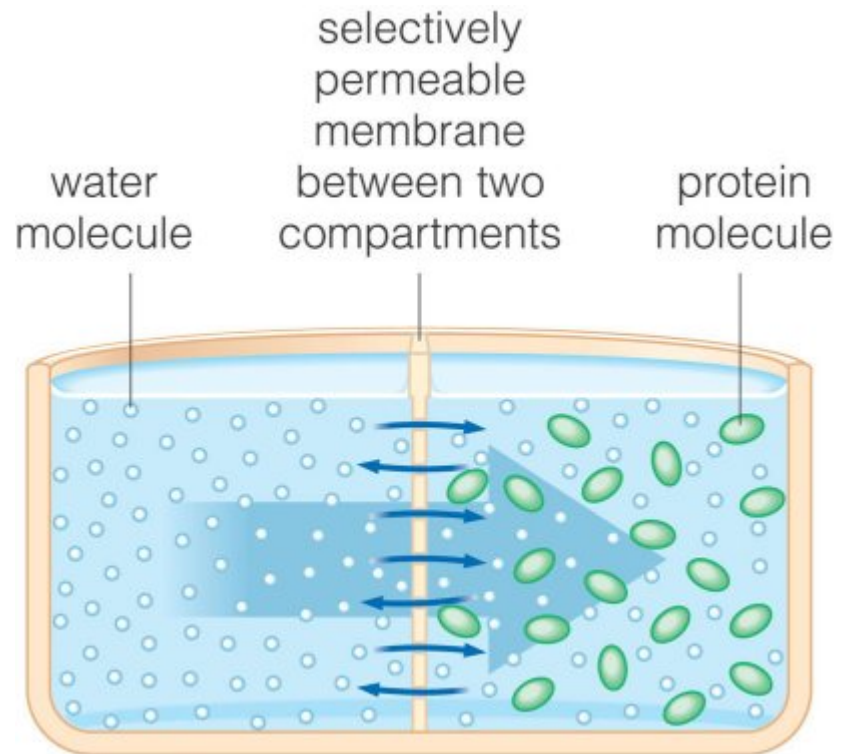
e. The solid part (the “mosaic”) is the variety of **proteins** etc. embedded in the bilayer.

f. Each phospholipid has a **hydrophobic** tail and a **hydrophilic** head



3. The membrane has consistency of light **machine oil**.

4. The membrane is **SELECTIVELY PERMEABLE** (will let some substances in but not others of the same size).



P. Cell Wall

1. Only in **plant** cells
2. Made of **cellulose** (sugars linked with a strong bond)
3. Very rigid (but porous) and difficult for animals to digest (think “wood”)
4. Small molecules have **little** difficulty penetrating the cell wall, while larger molecules may not be able to pass through. (the cell wall is said to be **semi-permeable**)

