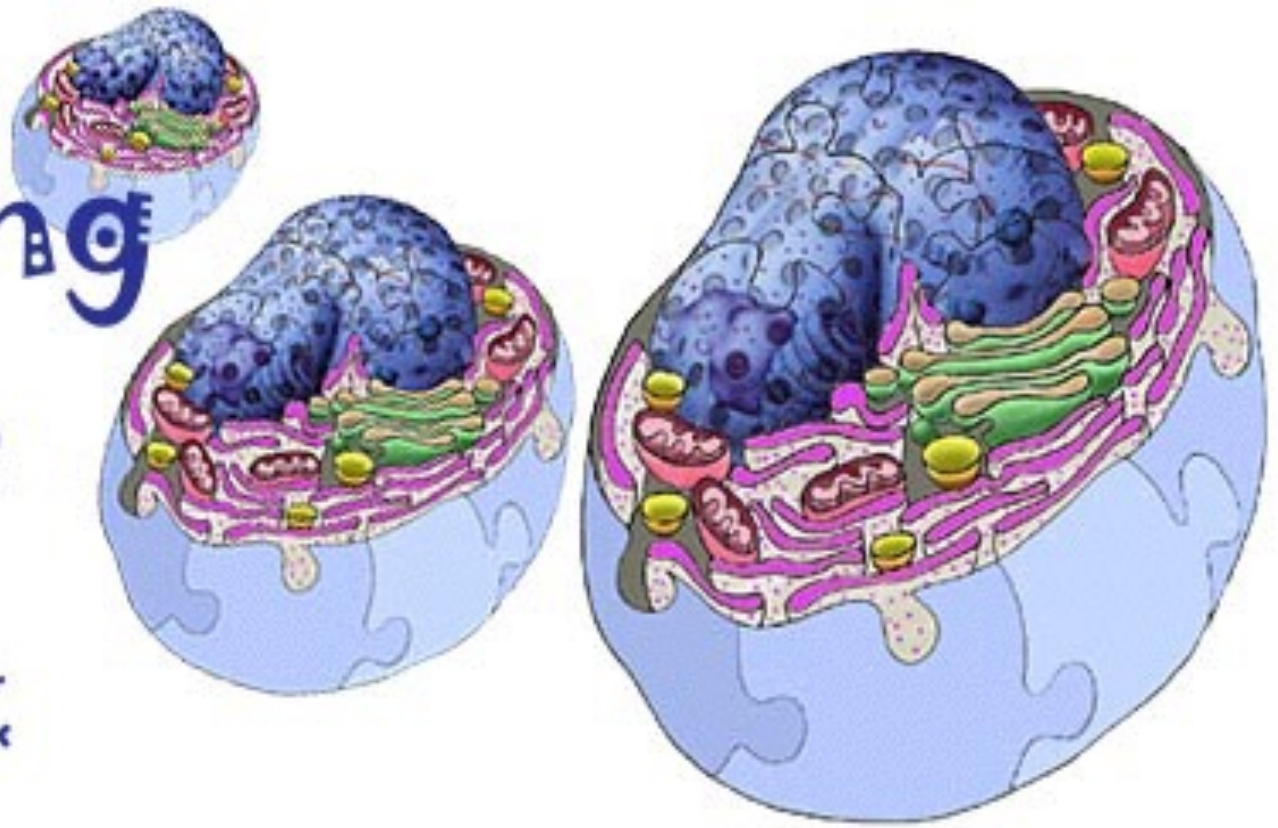


CELLS

Building
Blocks
of Life



INTERESTING FACTS

- **The longest cells in the human body are the motor neurons. They can be up to 1.37 meters long and go from the spinal cord to the big toe**
- **Every square inch of the human body has an average of 32 million bacteria on it.**
- **Humans shed about 600,000 particles of skin every hour - about 1.5 pounds a year. By 70 years of age, an average person will have lost 105 pounds of skin.**
- **Humans shed and regrow outer skin cells about every 27 days - almost 1,000 new skins in a lifetime**
- **The largest cell in the human body is the female egg cell. It is about 1/180 inch in diameter. The smallest cell in the human body is the male sperm. It takes about 175,000 sperm cells to weigh as much as a single egg cell.**
- **Three-hundred-million cells die in the human body every minute**

P.L.O.'S

A1. Describe the following cell structures and their functions:

Cell membrane, mitochondria, smooth and rough endoplasmic reticulum, ribosomes, Golgi bodies, vesicles, vacuoles, lysosomes, nuclear envelope, nucleus, nucleolus, and chromosomes.

A2. identify the functional interrelationships of cell structures

A3. identify the cell structures in diagrams and electron micrographs

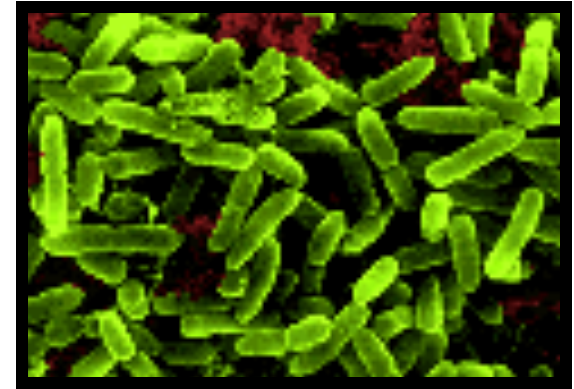
Vocabulary

_____ ATP	_____ Mitochondria
_____ Cellular respiration	_____ Nucleolus
_____ Centriole	_____ Nucleoplasm
_____ Chromatin	_____ Nucleus
_____ Cytoskeleton	_____ Prokaryotic
_____ Endoplasmic reticulum	_____ Protein synthesis
_____ Eukaryotic	_____ Ribosomes
_____ Flagellum	_____ Rough ER
_____ Golgi apparatus	_____ Saccule
_____ Hydrolysis	_____ Smooth ER
_____ Hydrolytic enzymes	_____ Vacuole
_____ Lipid manufacture	_____ Vesicle
_____ Lysosome	

TYPES OF CELLS

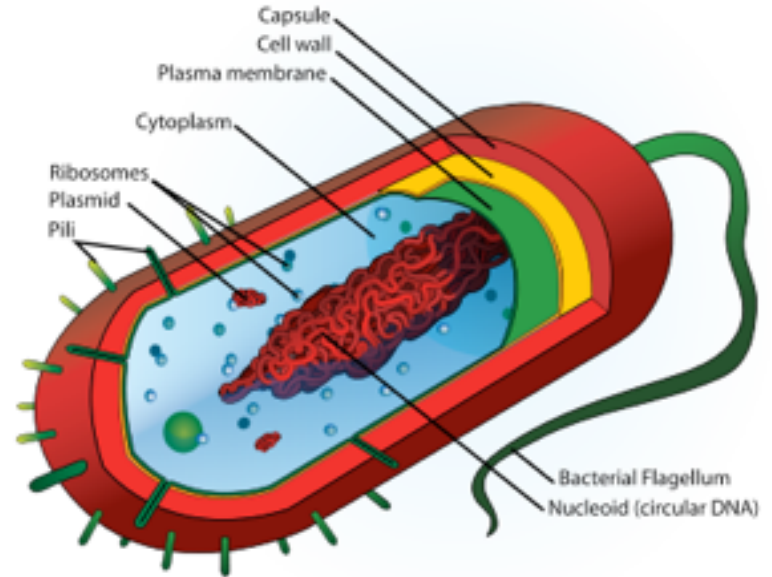
There are two types of cells:

1. Prokaryotic Cells
2. Eukaryotic Cells



PROKARYOTIC CELLS

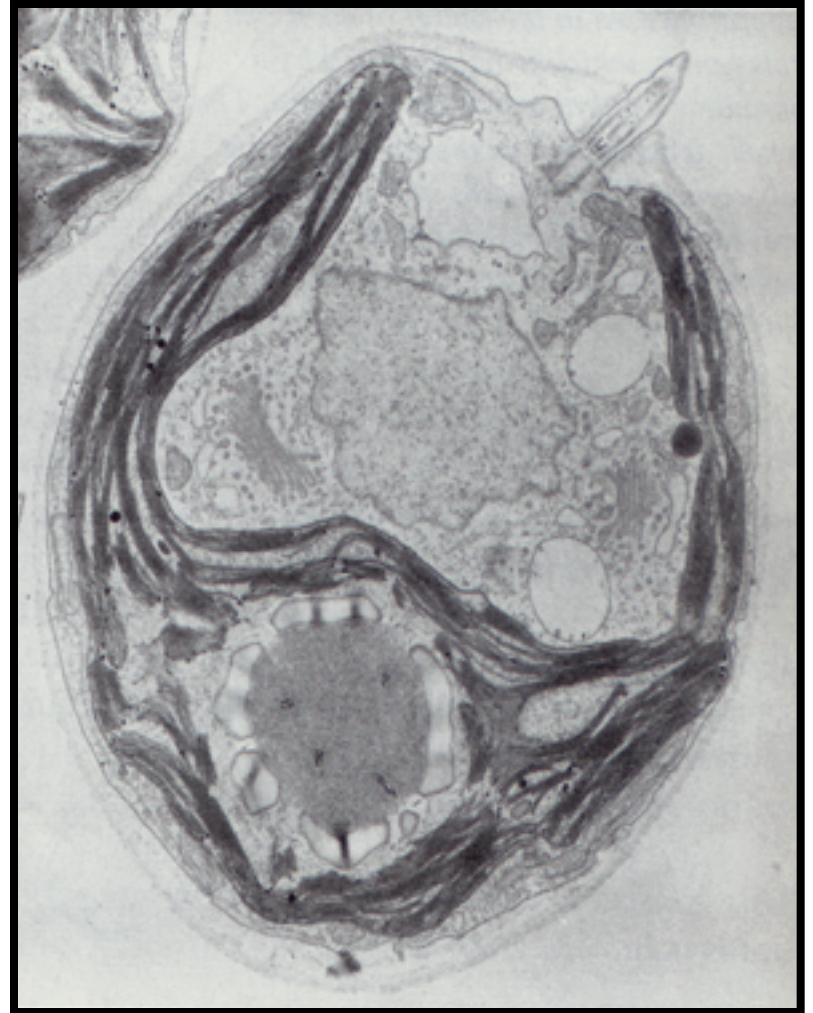
1. *pro* = before
2. *karyotic* = nucleus
3. These were the first cells.
4. They were primitive, small, had no defined nucleus (no nuclear membrane), and no membrane bound cell organelles.
5. They had ribosomes

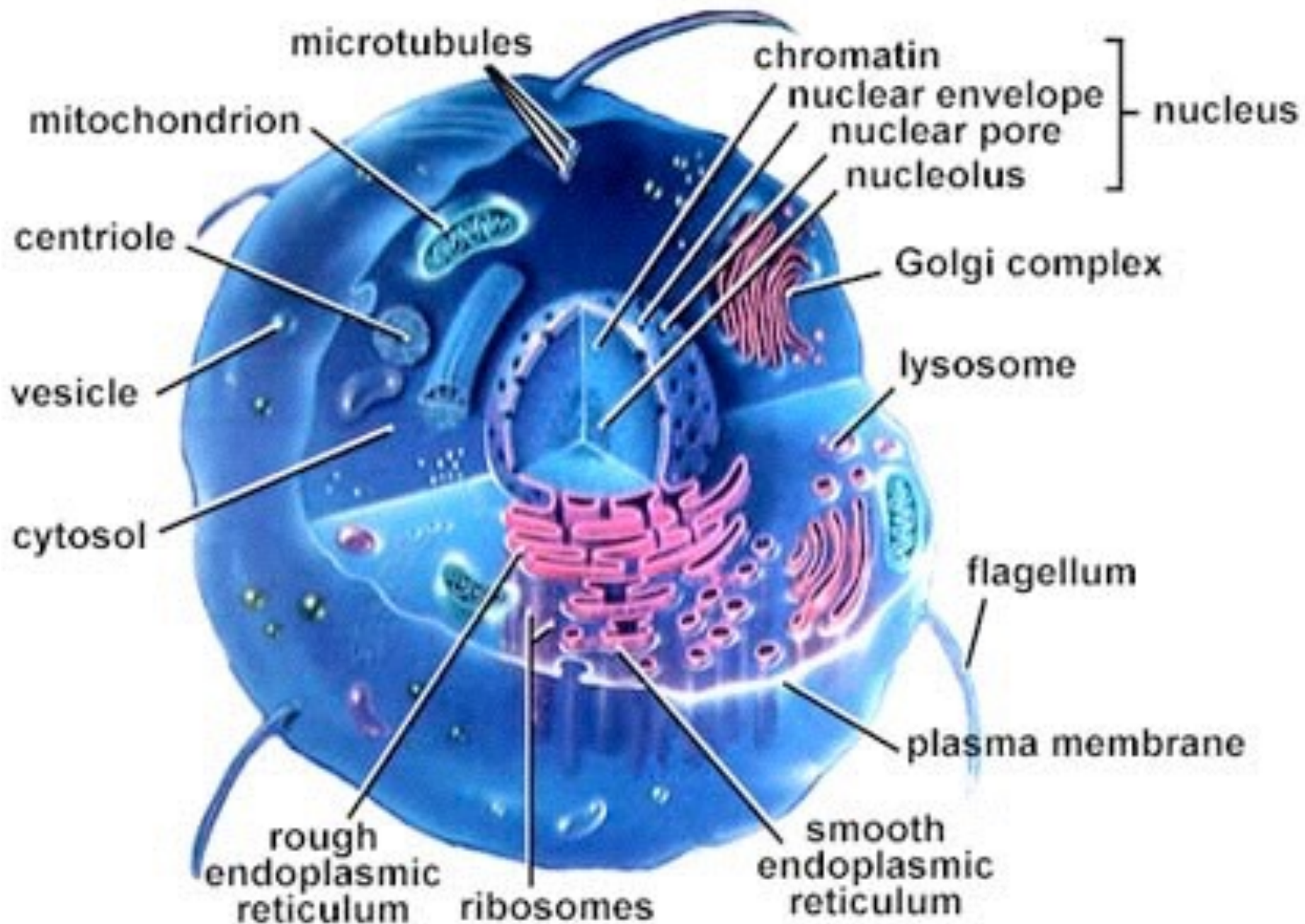




EUKARYOTIC CELLS

1. *eu* = true
2. *karyotic* = nucleus
3. These are modern cells.
4. They have a nucleus and membrane-bound organelles.
5. They are much larger (up to 1000X larger).



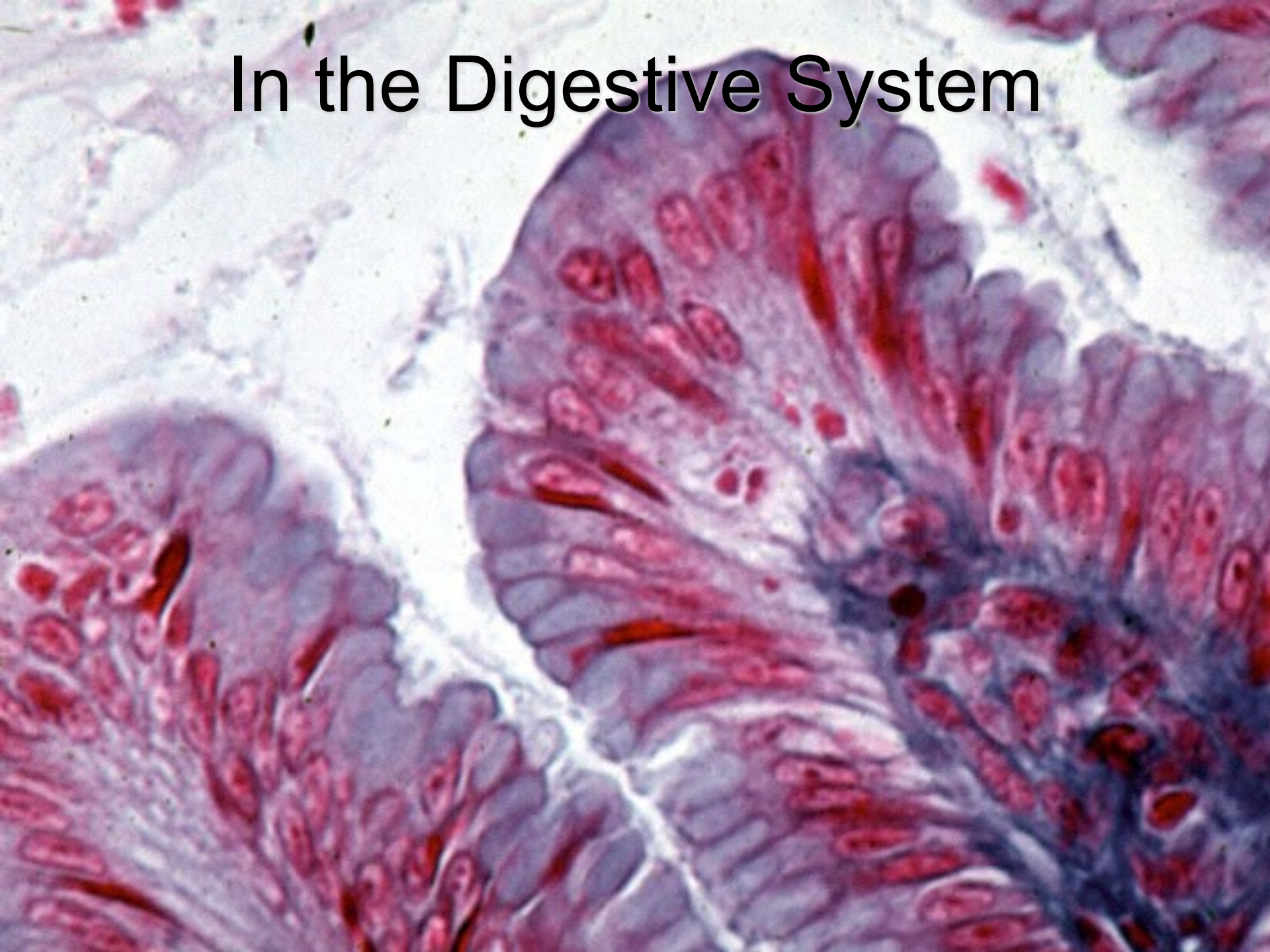


Thick skin



LUMEN

In the Digestive System

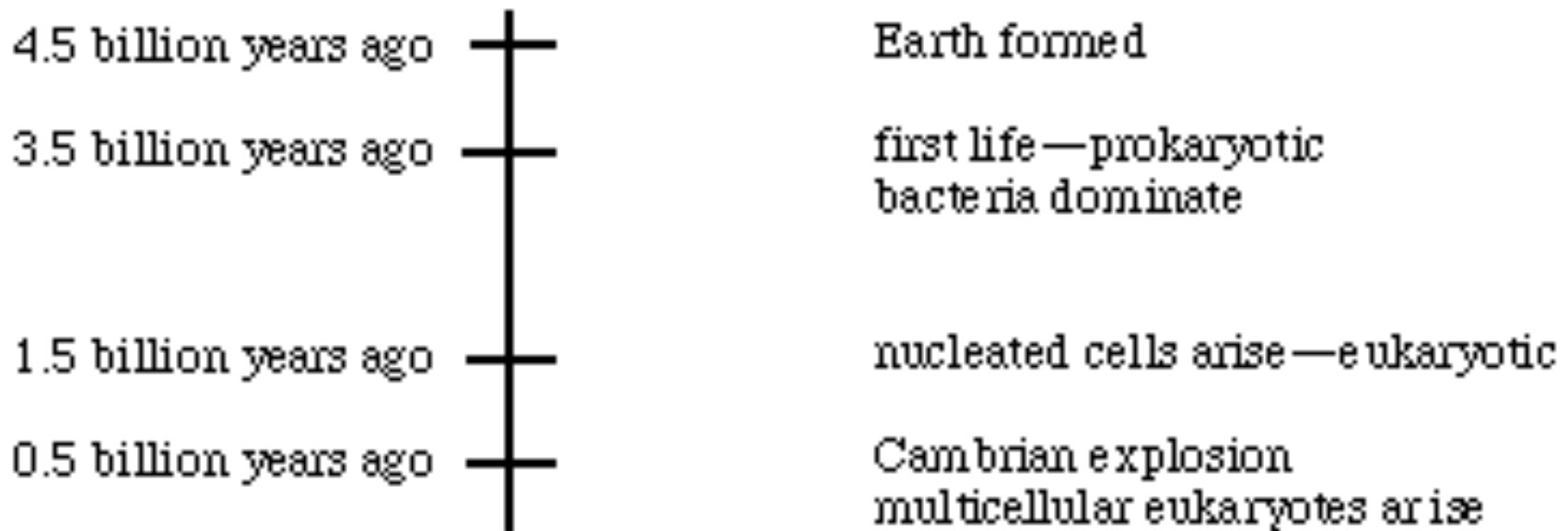




Female reproductive tract

EVOLUTION OF CELLS

A Brief History of Life on Earth



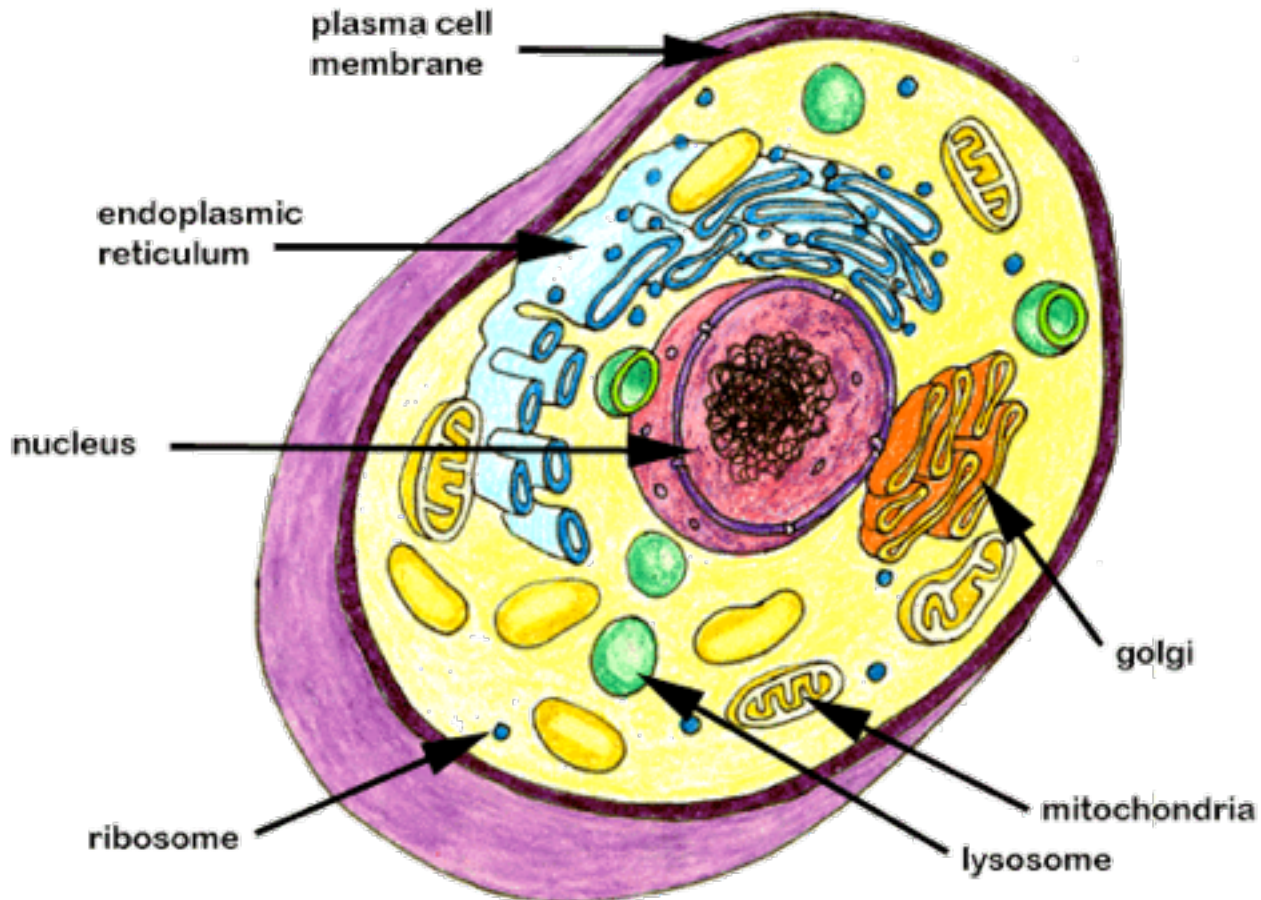
Since life first appeared on Earth some 3.8 billion years ago, it has been estimated that more than 99.9% of all species have gone extinct.

CELL THEORY

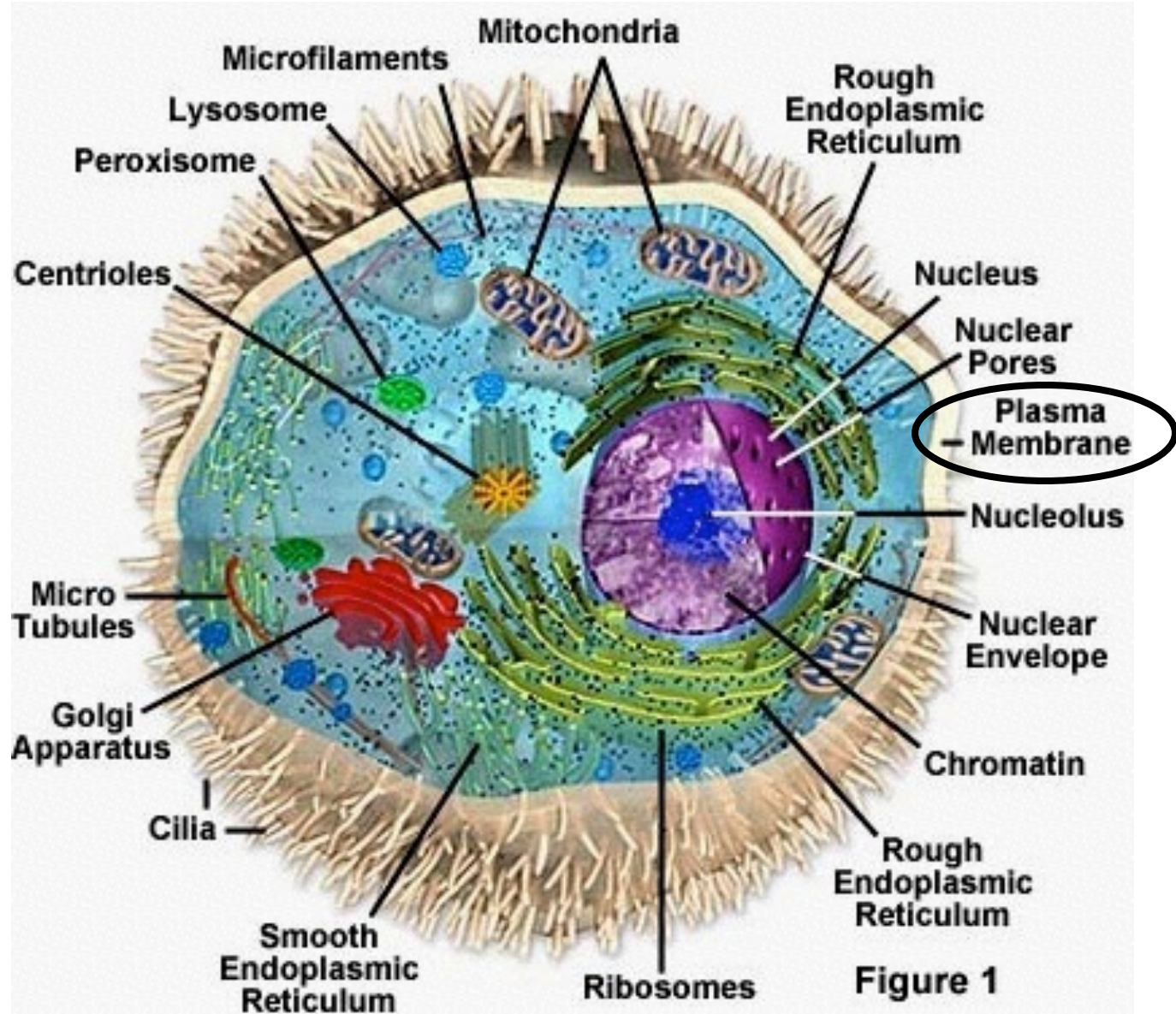
- All living things are made up of cells
- The cell is also the functional unit of life
- All living cells come from pre-existing cells

CELL STRUCTURE

The cell is the basic unit of life and contains internal structures called **ORGANELLES**.



ORGANELLES

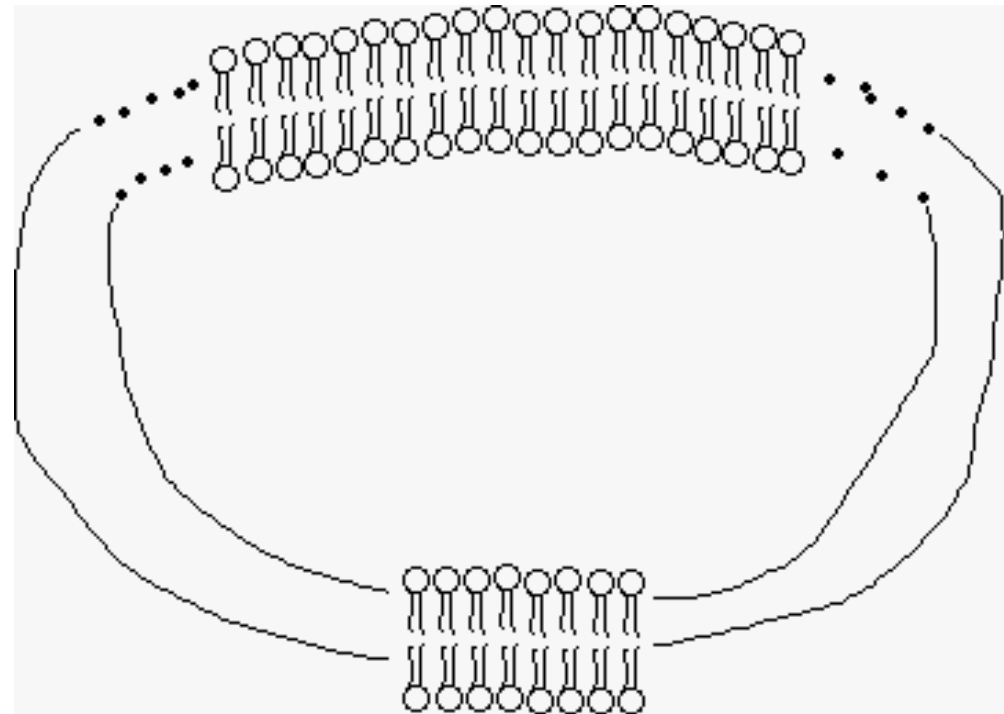


Plasma Membrane

This is a universal structure. It is the same in all organisms.

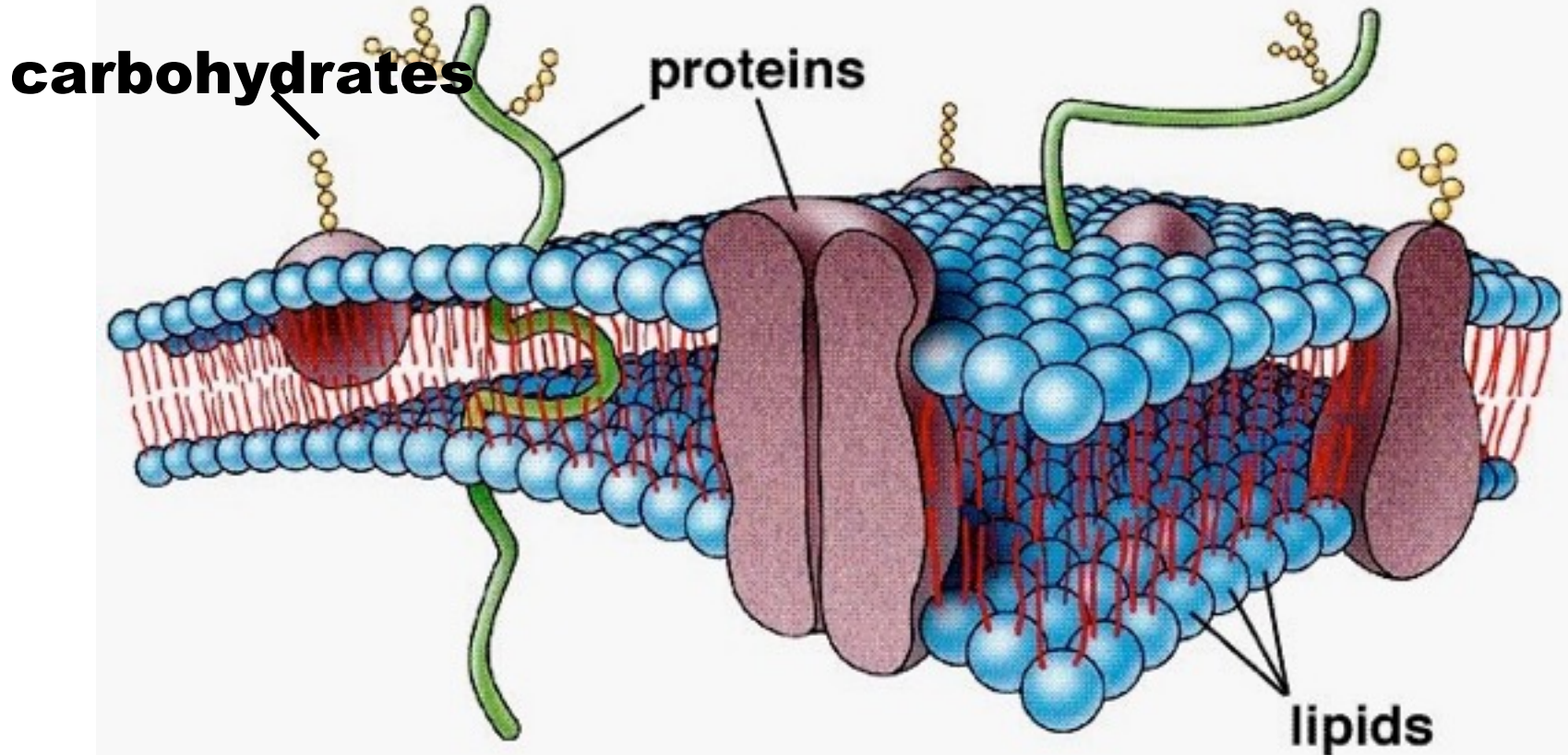
The cell membrane is composed of a bi-layer of phospholipids with proteins embedded in it.

Most of the organelles inside the cell also have a bilayer membrane.

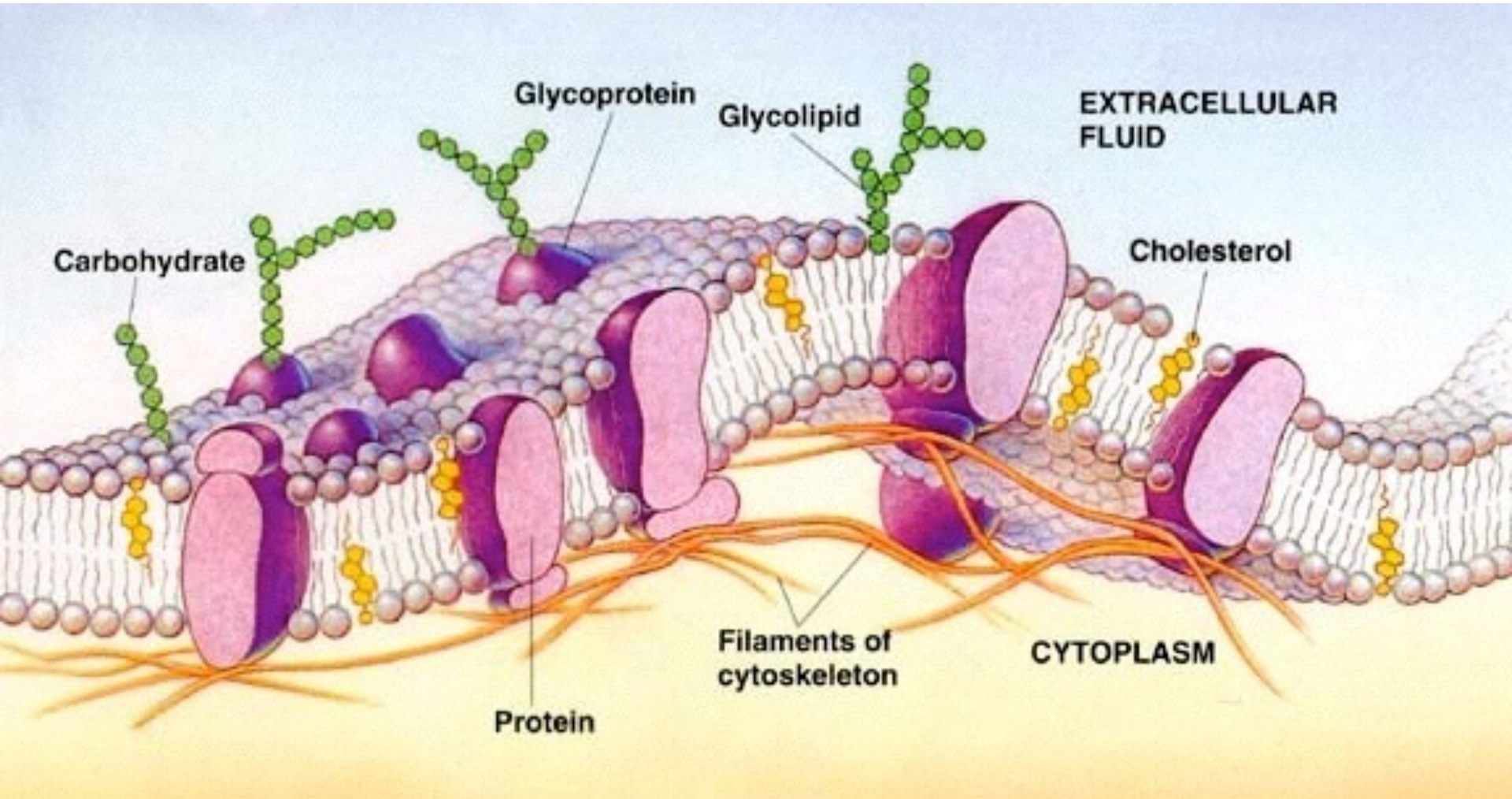


Plasma Membrane

The model used to explain the cell membrane is called the **FLUID MOSAIC MODEL**.

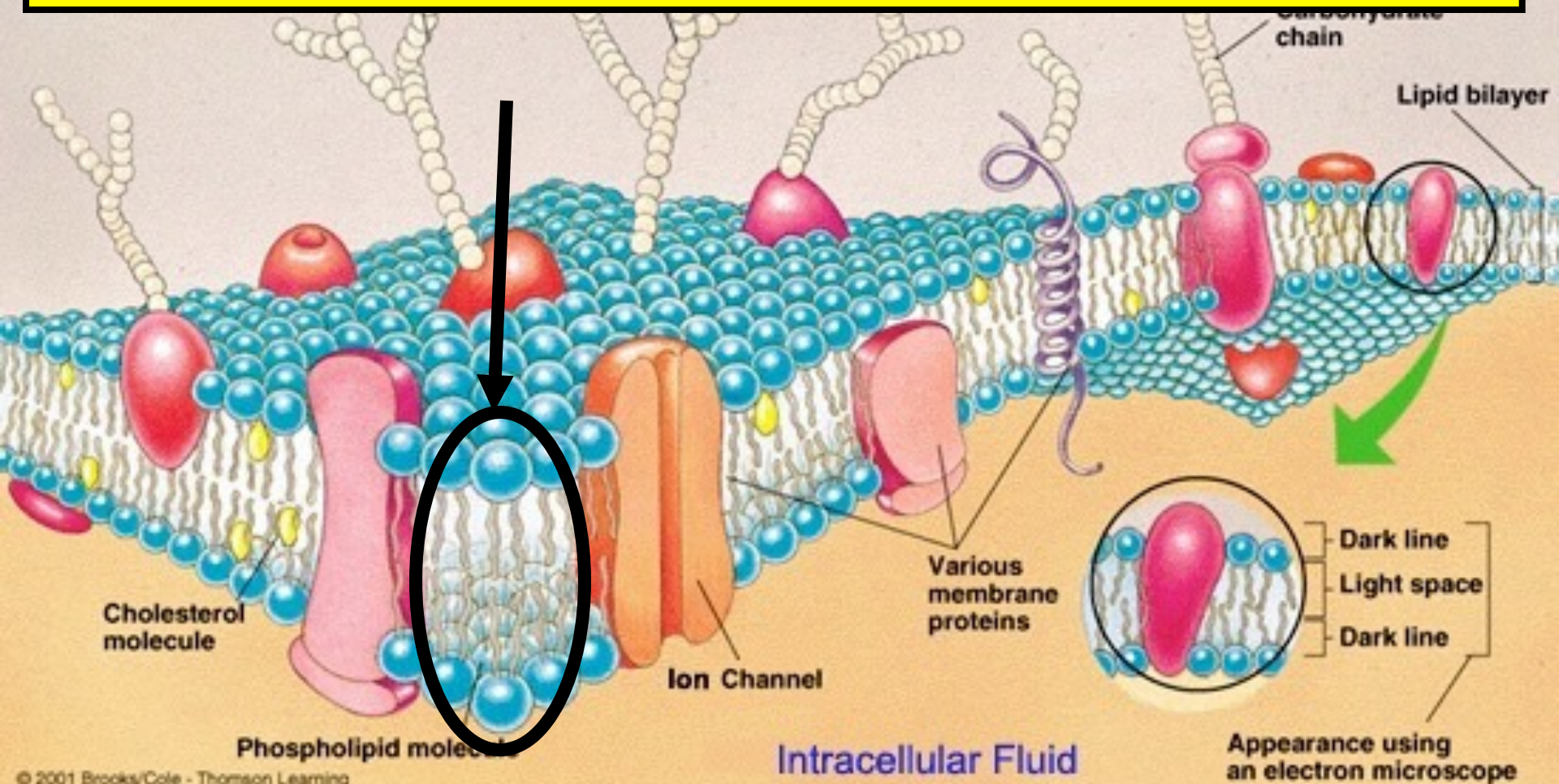


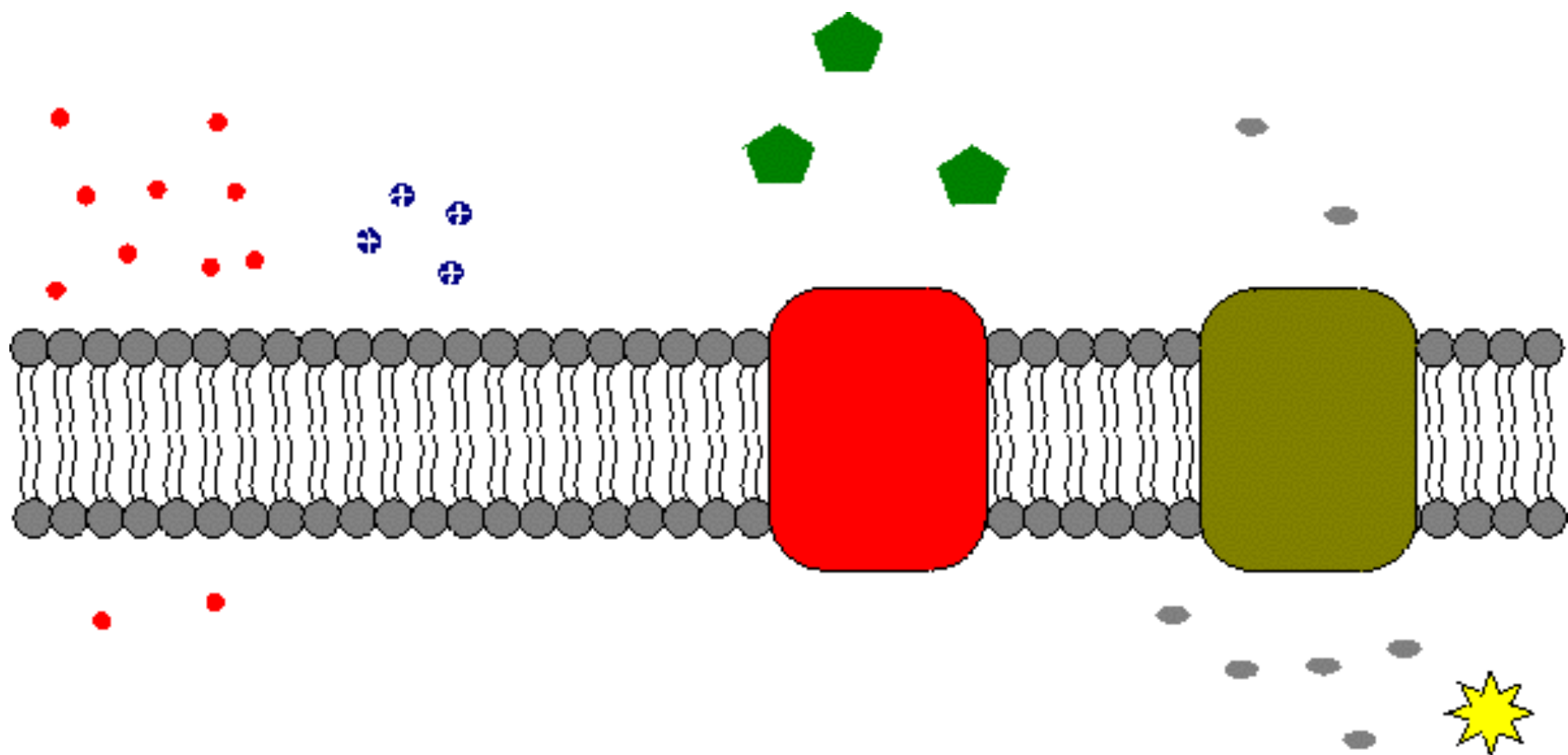
fluid mosaic model



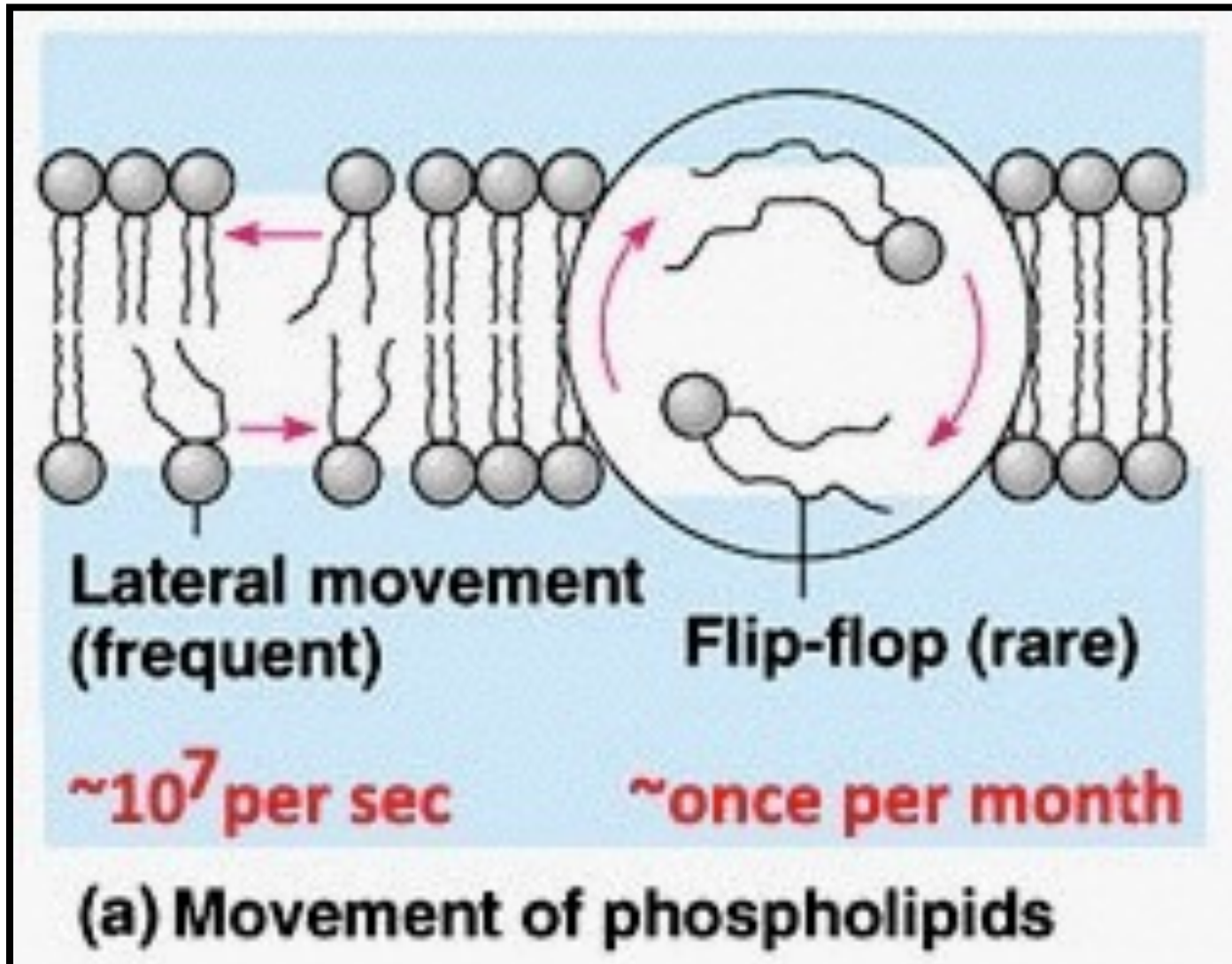
fluid mosaic model

SELECTIVELY PERMEABLE: Controls what comes in and out of the cell. Does not let large, charged or polar things through.



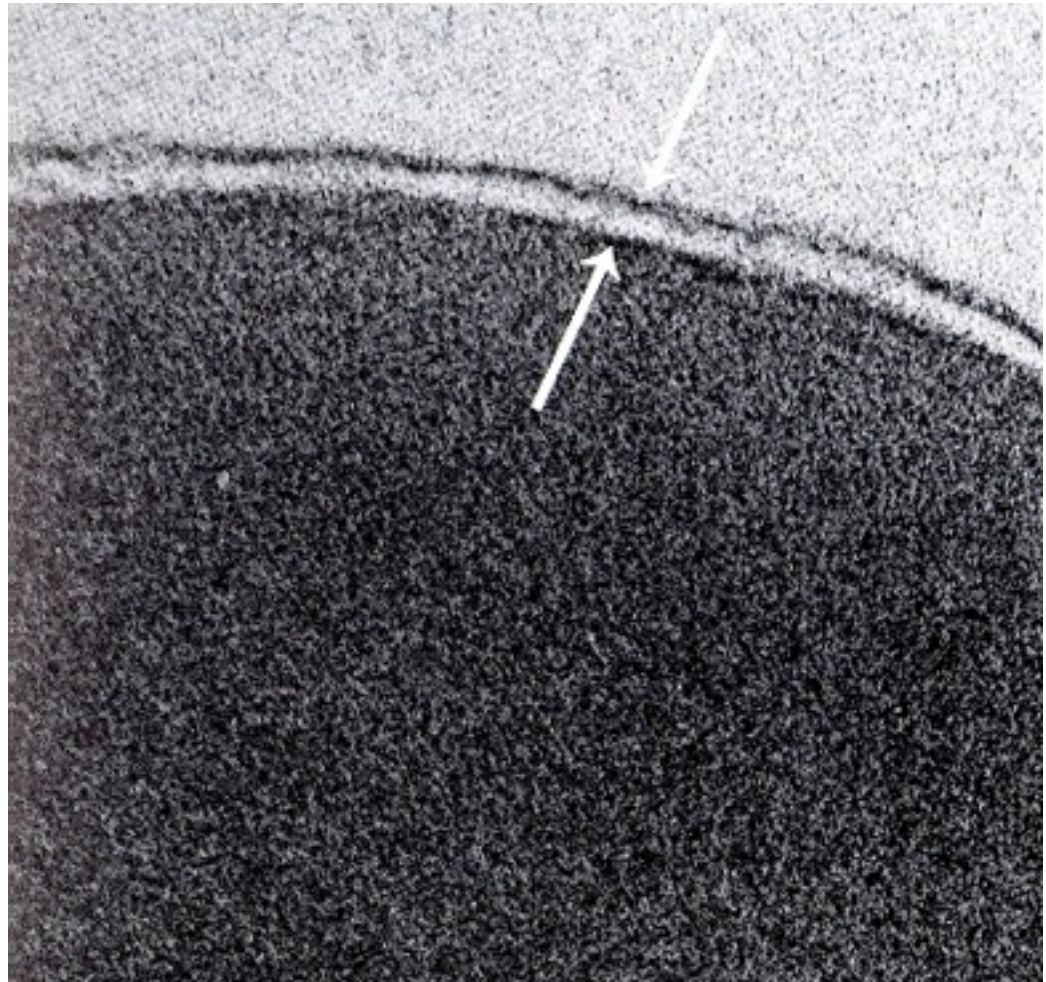


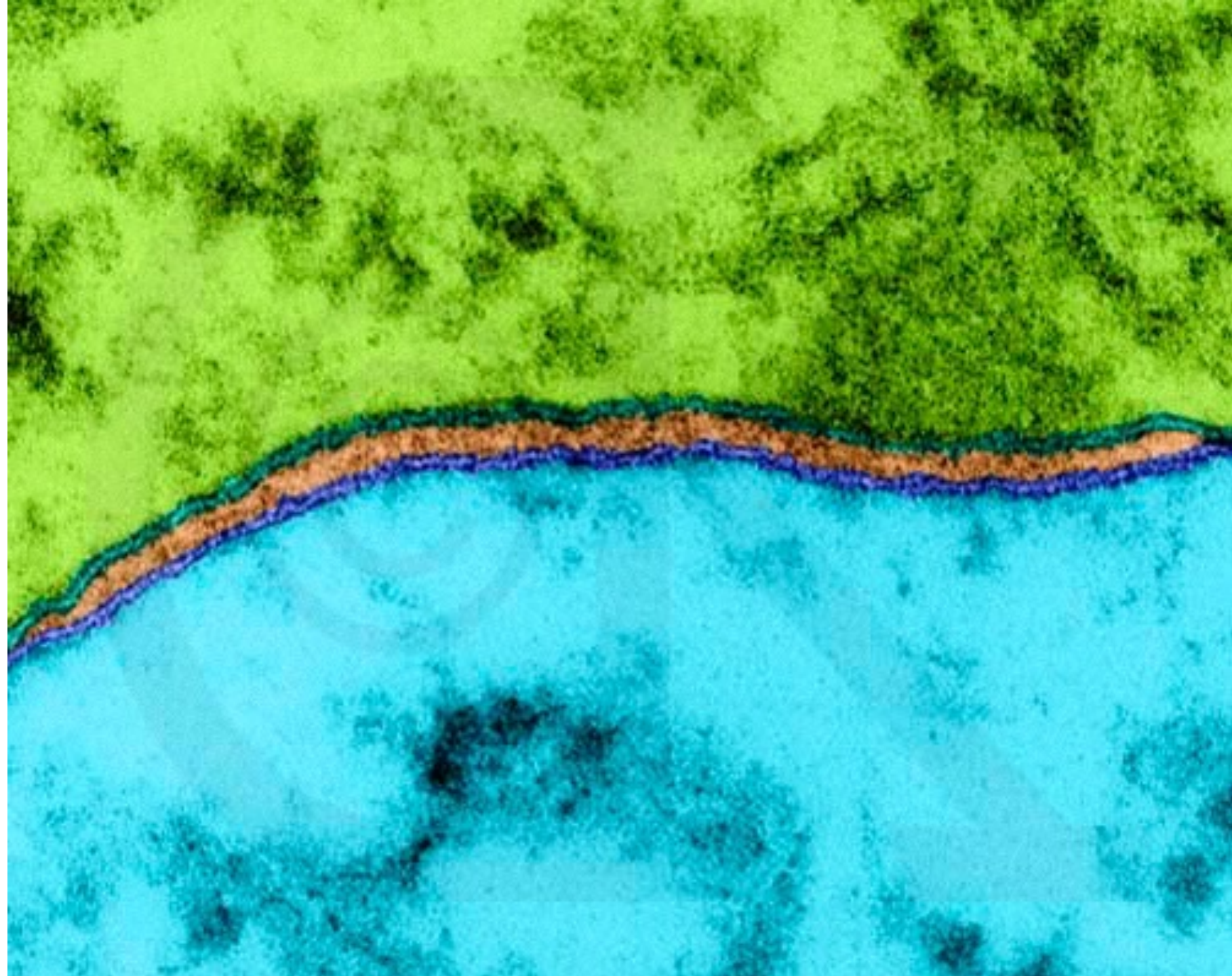
FLUID MOSAIC MODEL: The phospholipids move, thus allowing small non-polar molecules to slip through.



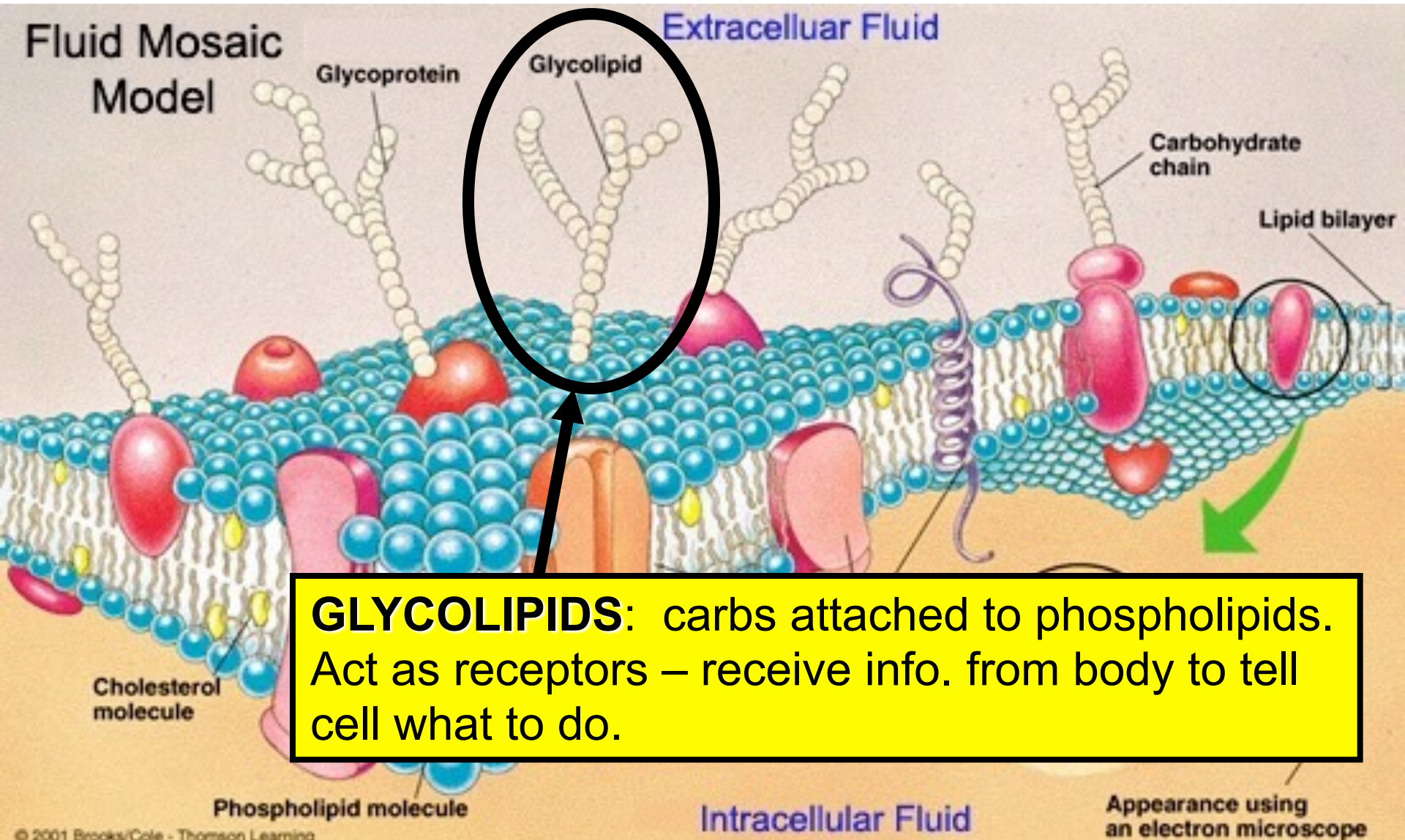
phospholipid bilayer

PHOSPHOLIPID BILAYER: Double layered membrane.

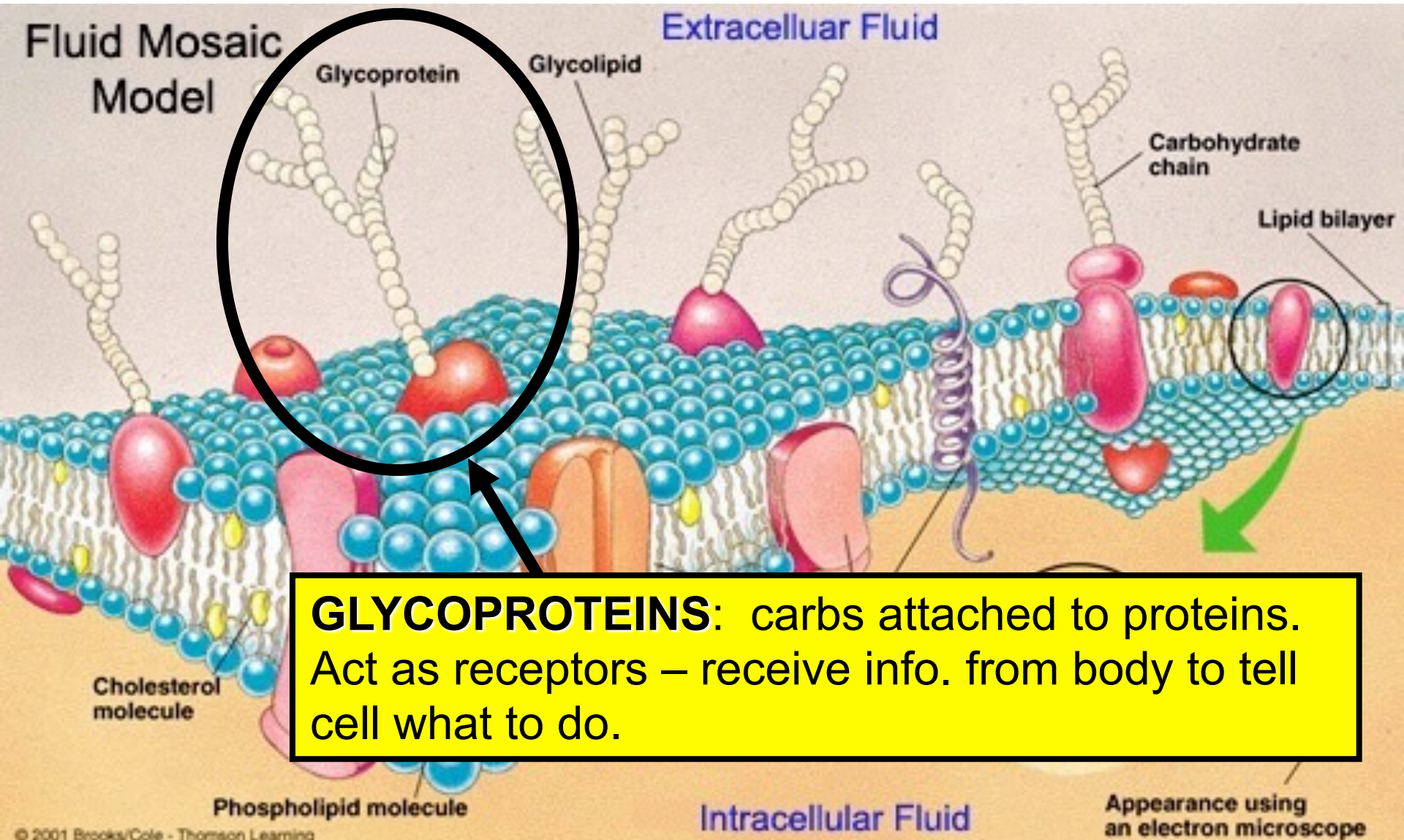


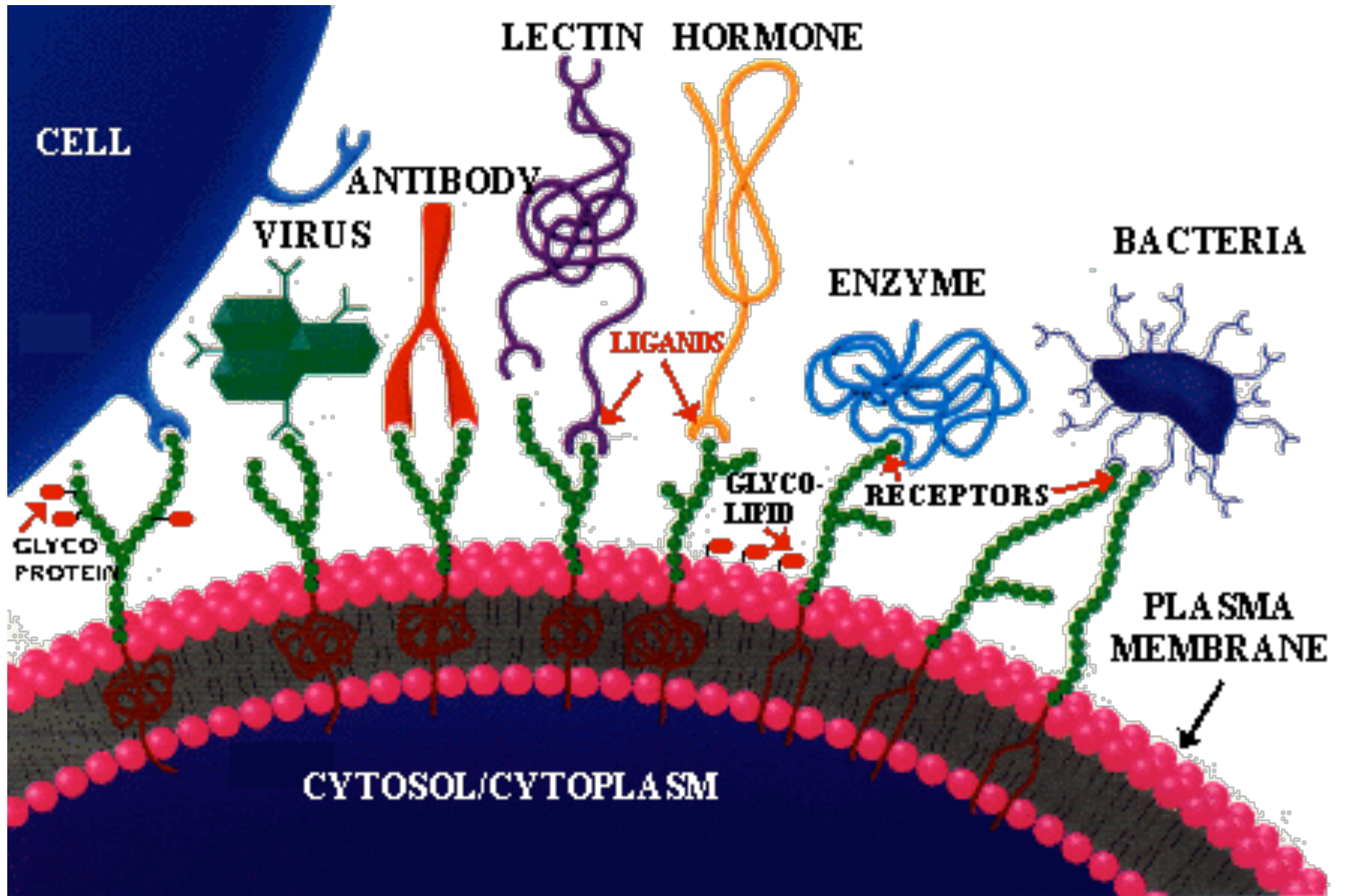


fluid mosaic model



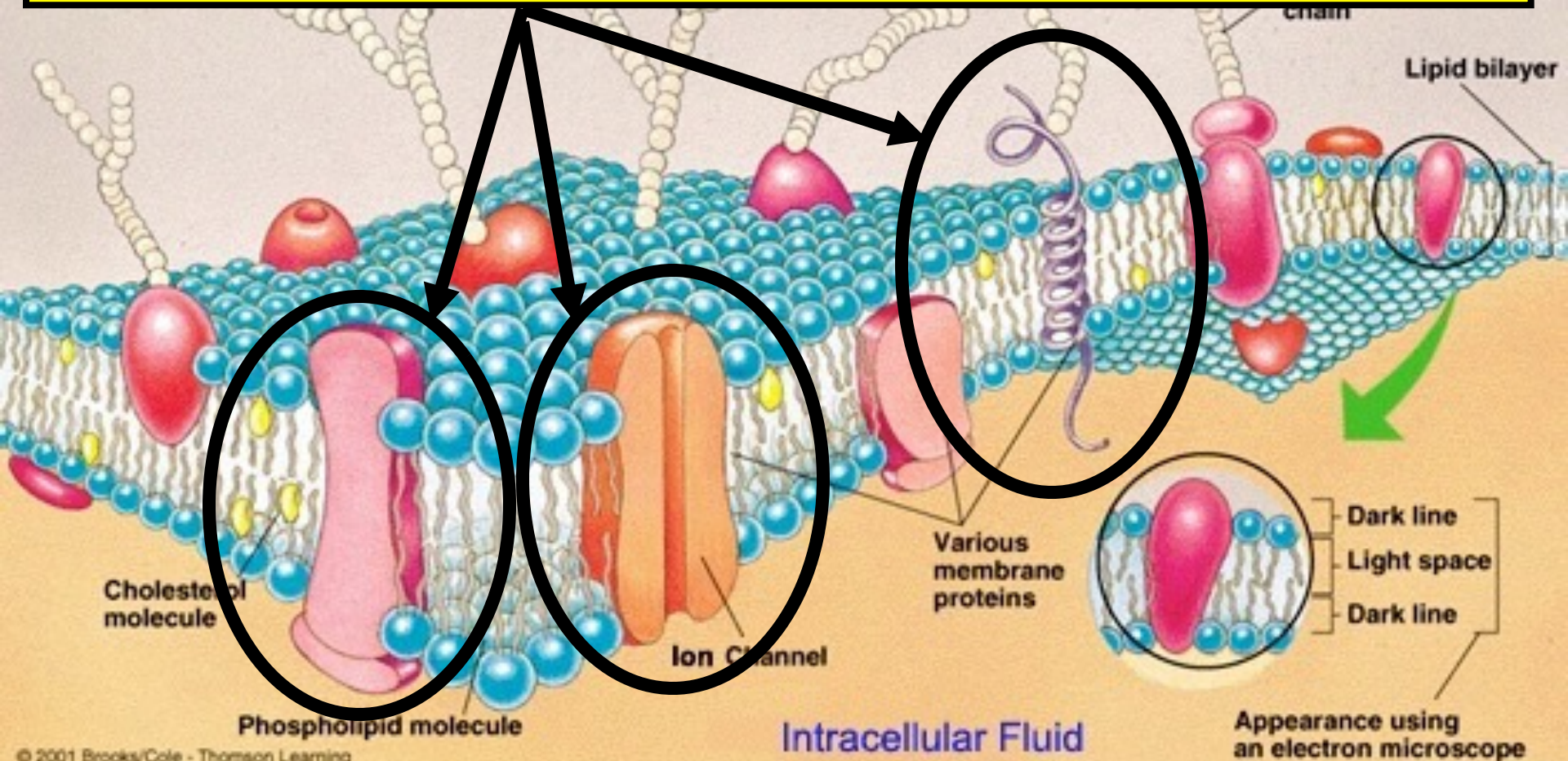
fluid mosaic model



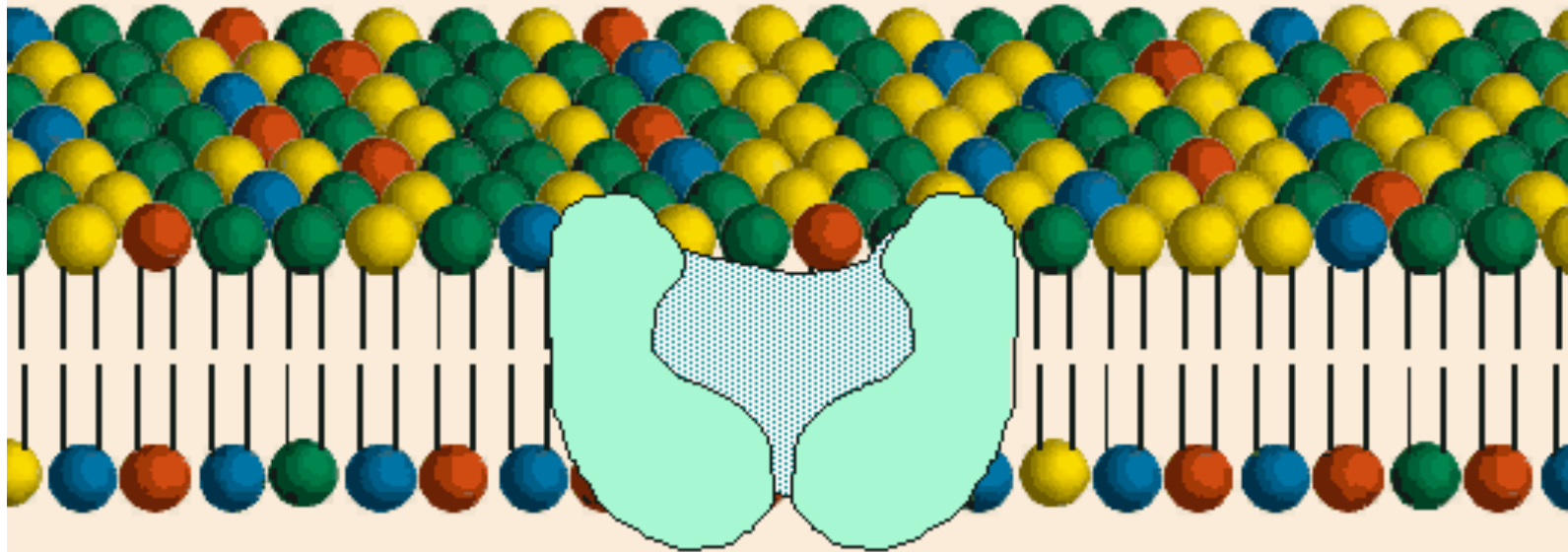
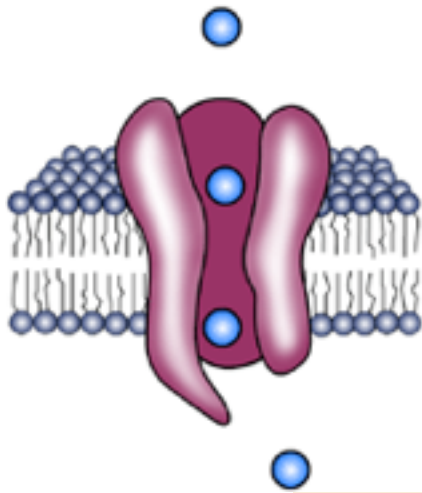


fluid mosaic model

INTEGRAL PROTEINS: assists specific larger and charged molecules to move in and out of the cell. Can act as 'tunnels' or will change shape.

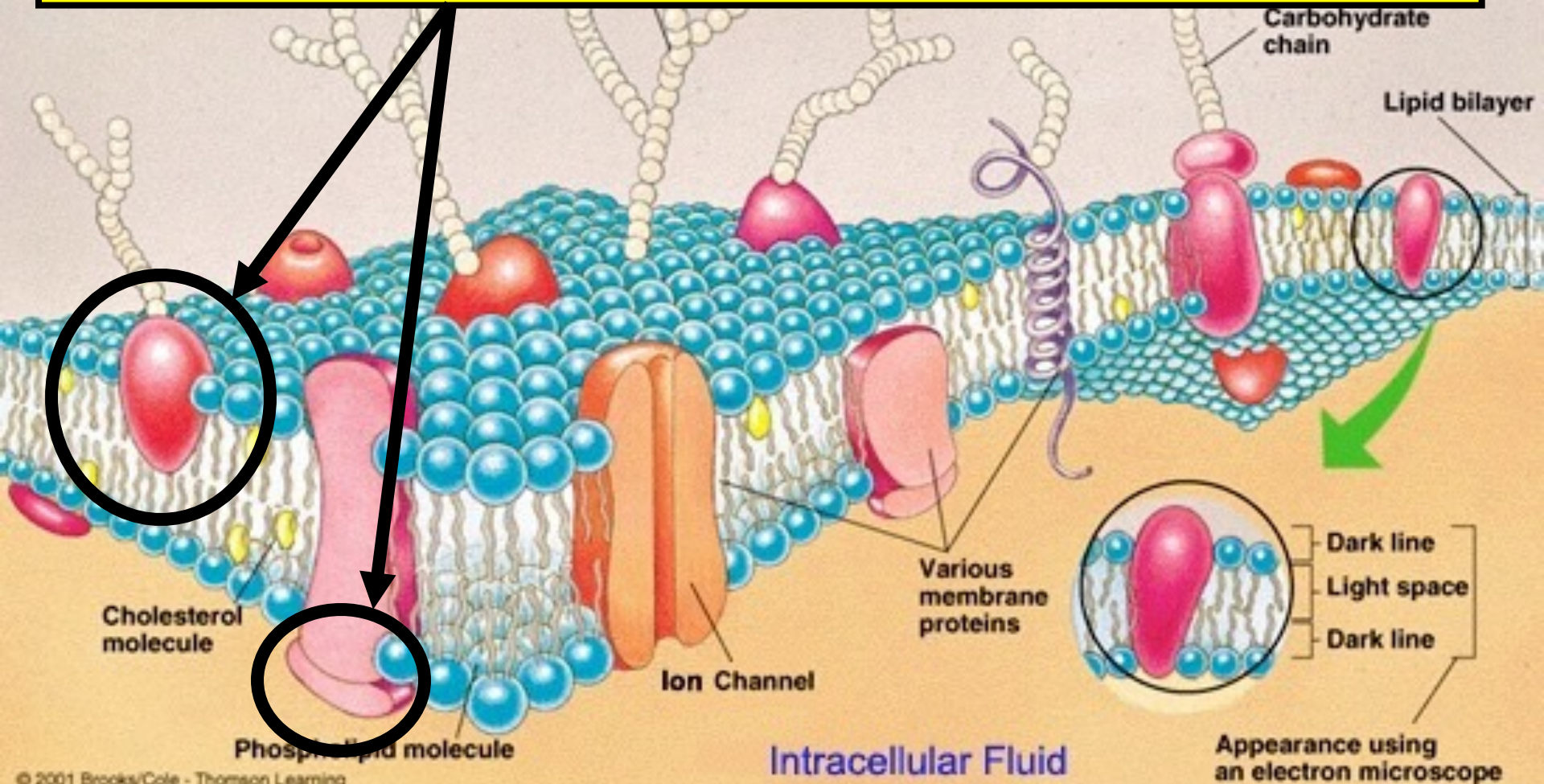


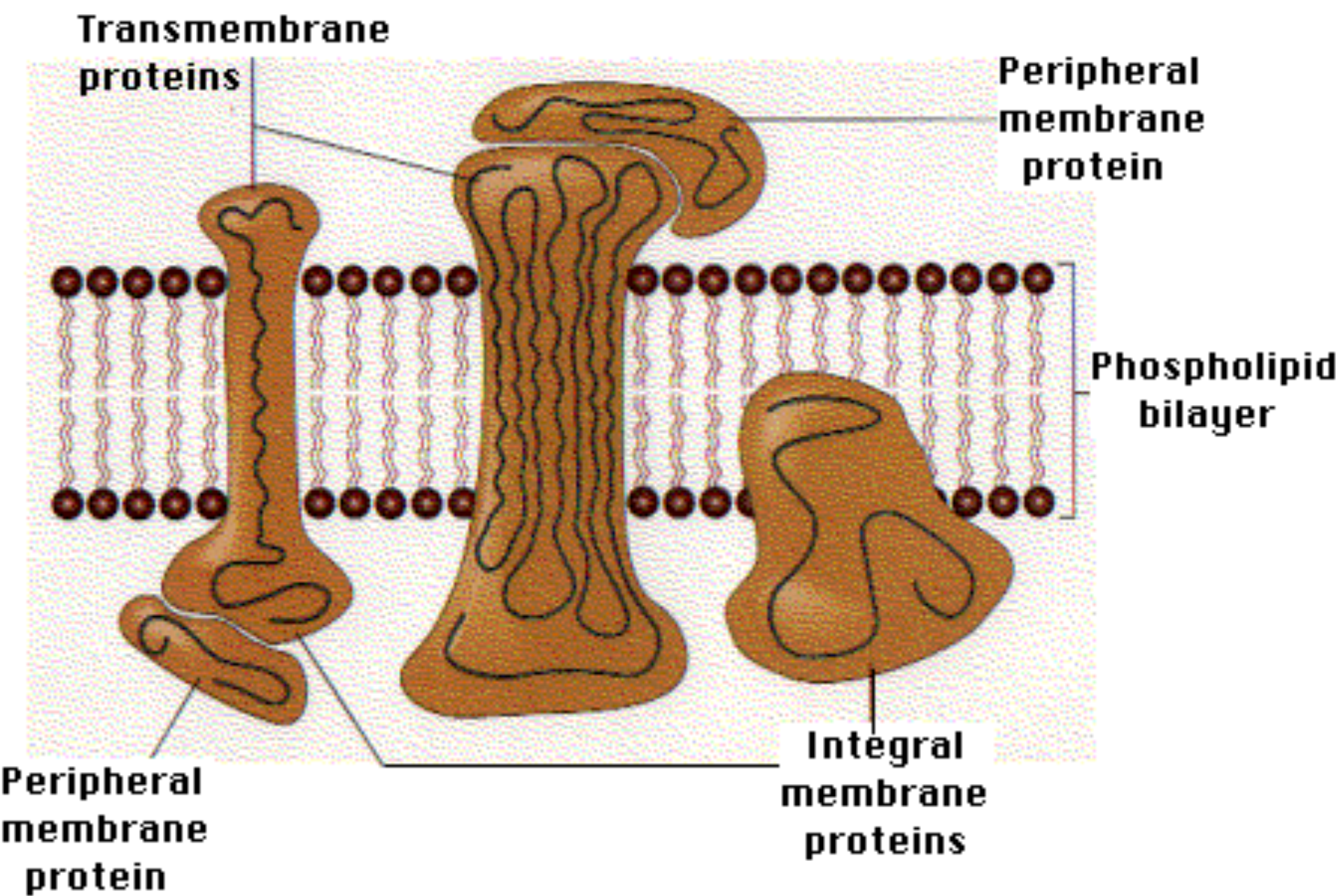
ion channels



fluid mosaic model

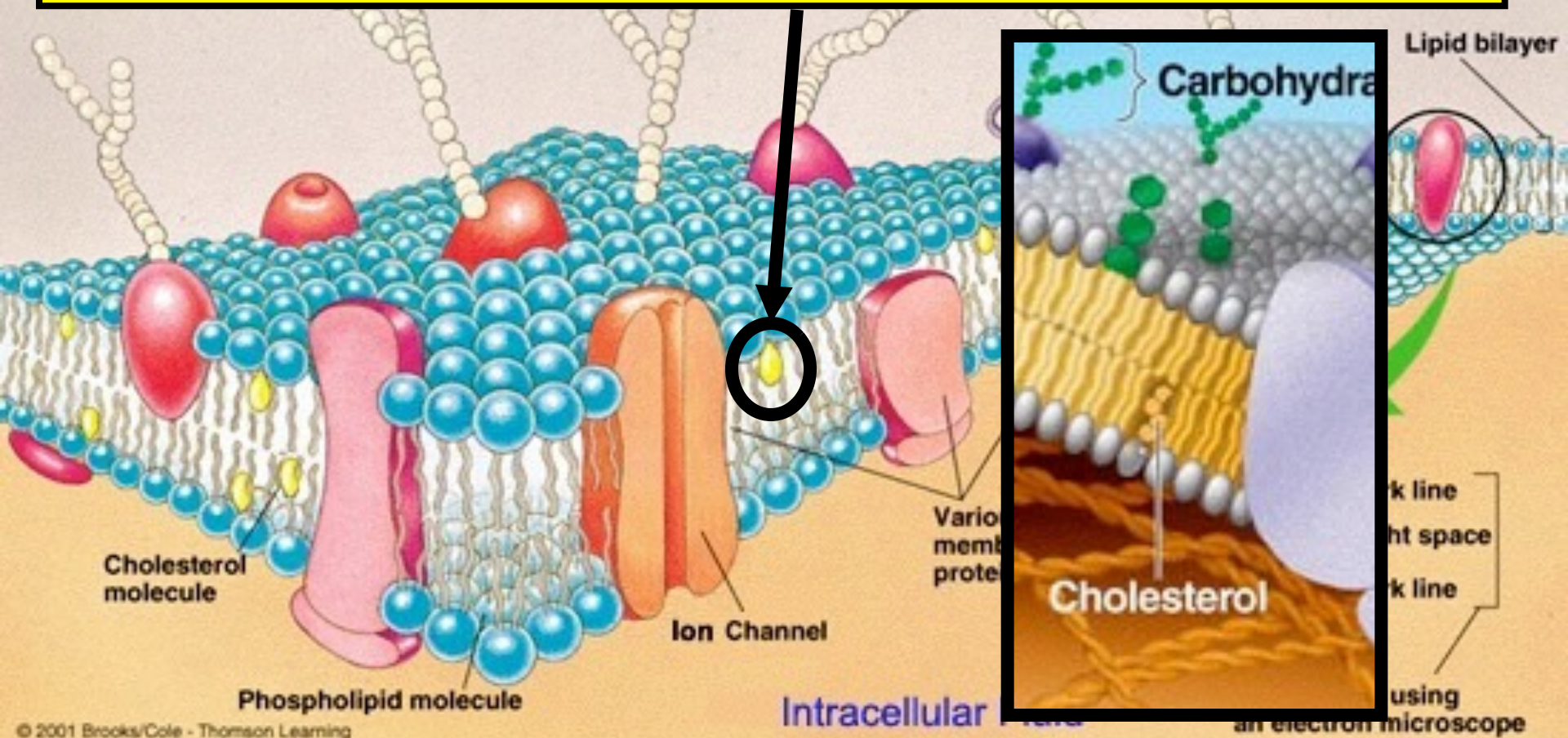
PERIPHERAL PROTEINS: They only go through a part of the membrane, or sit on top of another protein.





fluid mosaic model

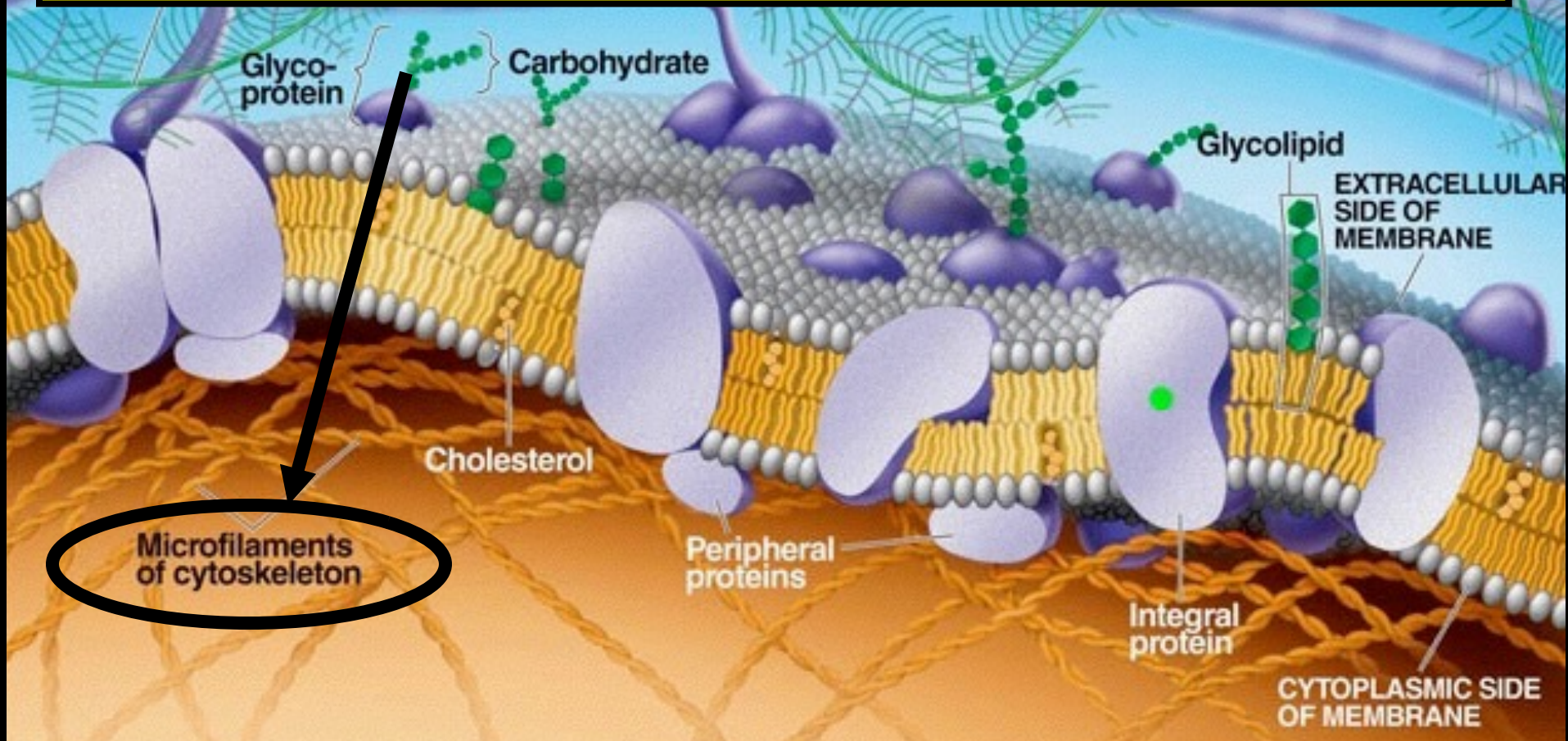
CHOLESTEROL: Reduces membrane fluidity by reducing phospholipid movement. Also stops the membrane from becoming solid at room temperatures.

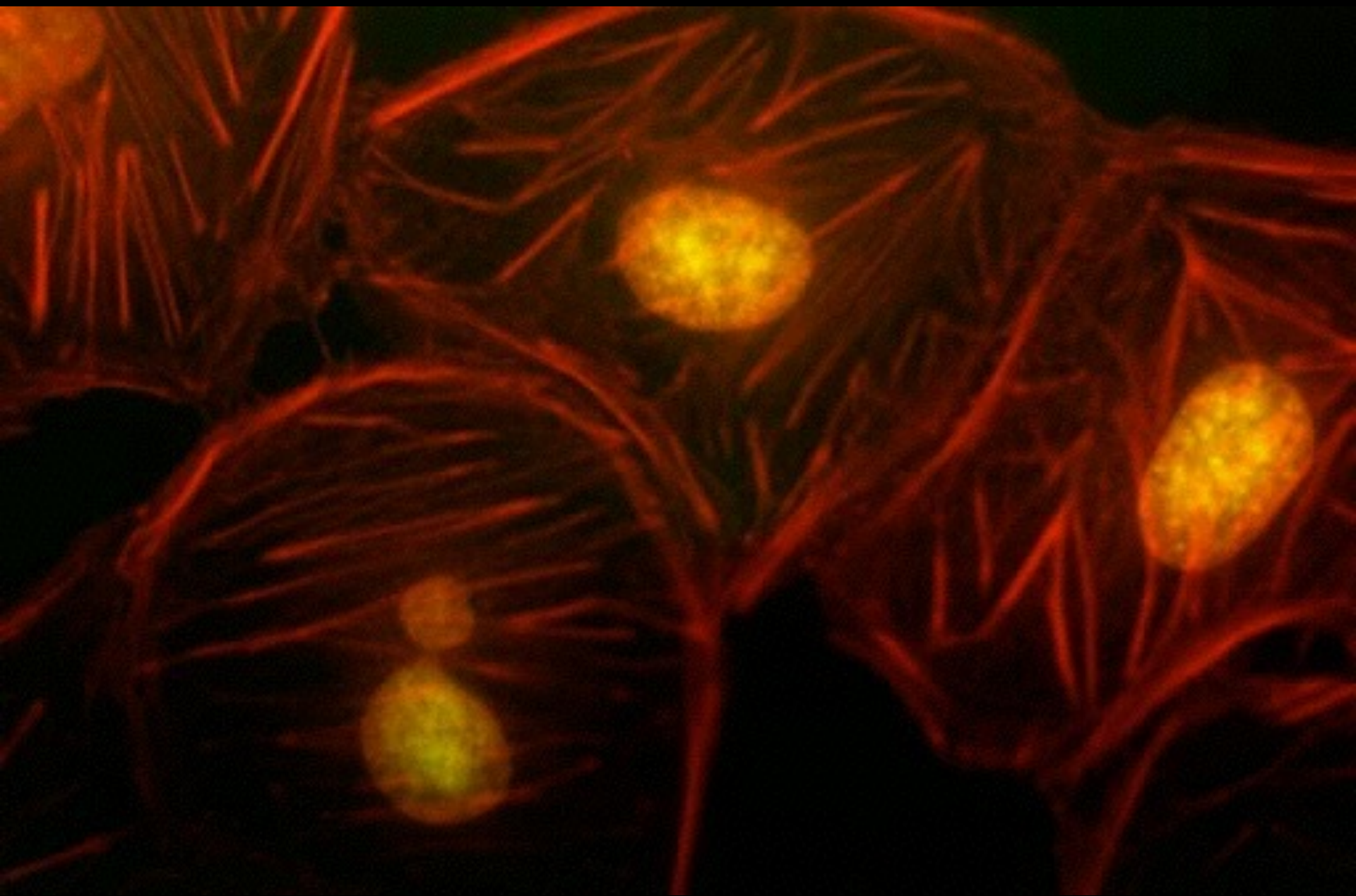


fluid mosaic model

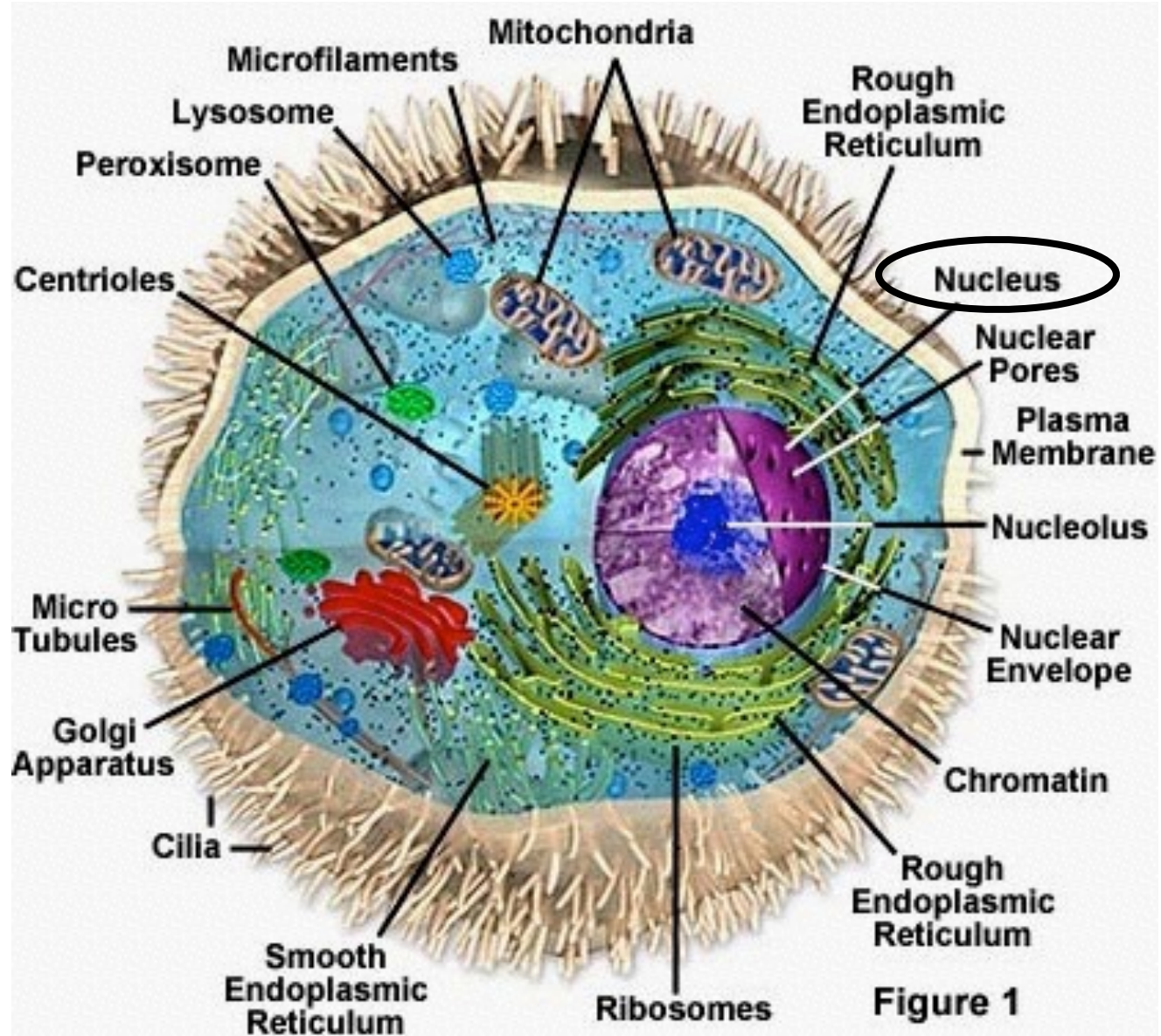
Fibers of extracellular matrix (ECM)

CYTOSKELETON: A cytoskeleton acts as a framework that gives the cell its shape. It also serves as a monorail to transport organelles around the cell.





ORGANELLES



NUCLEUS

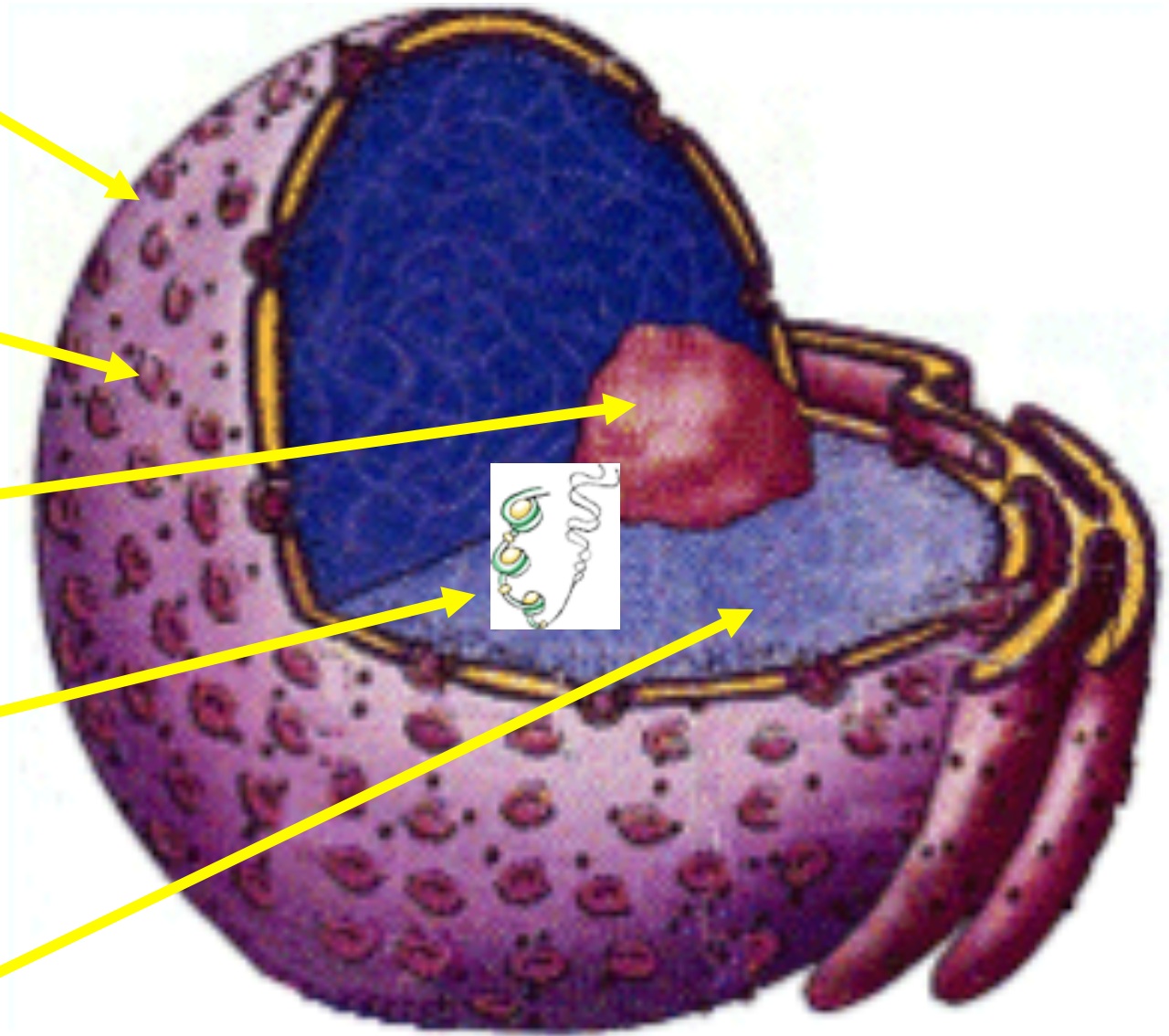
Nuclear membrane

Nuclear pore

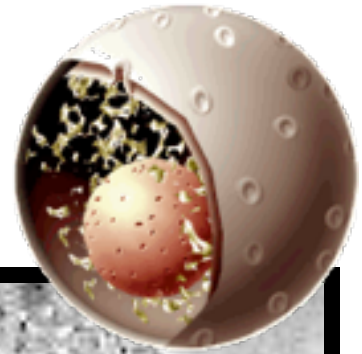
Nucleolus

Chromatin

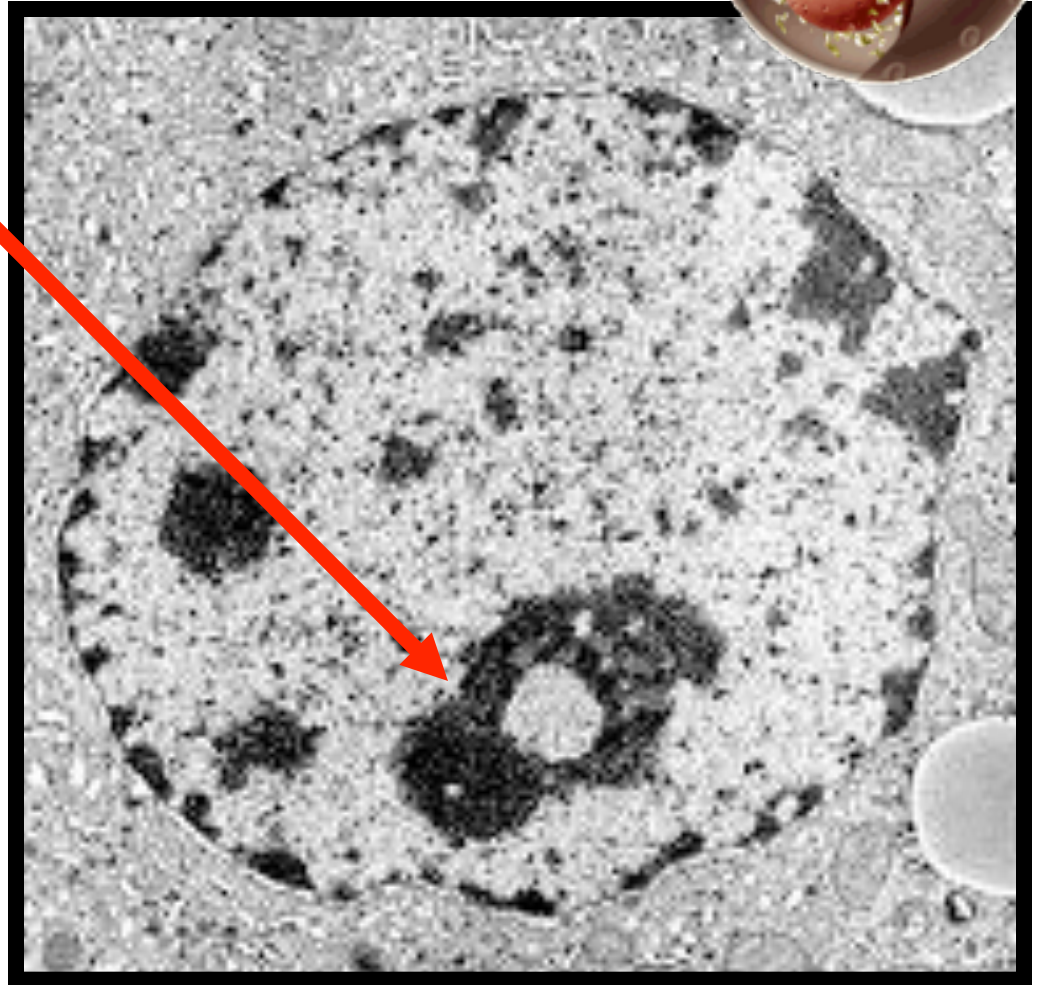
Nucleoplasm



NUCLEUS

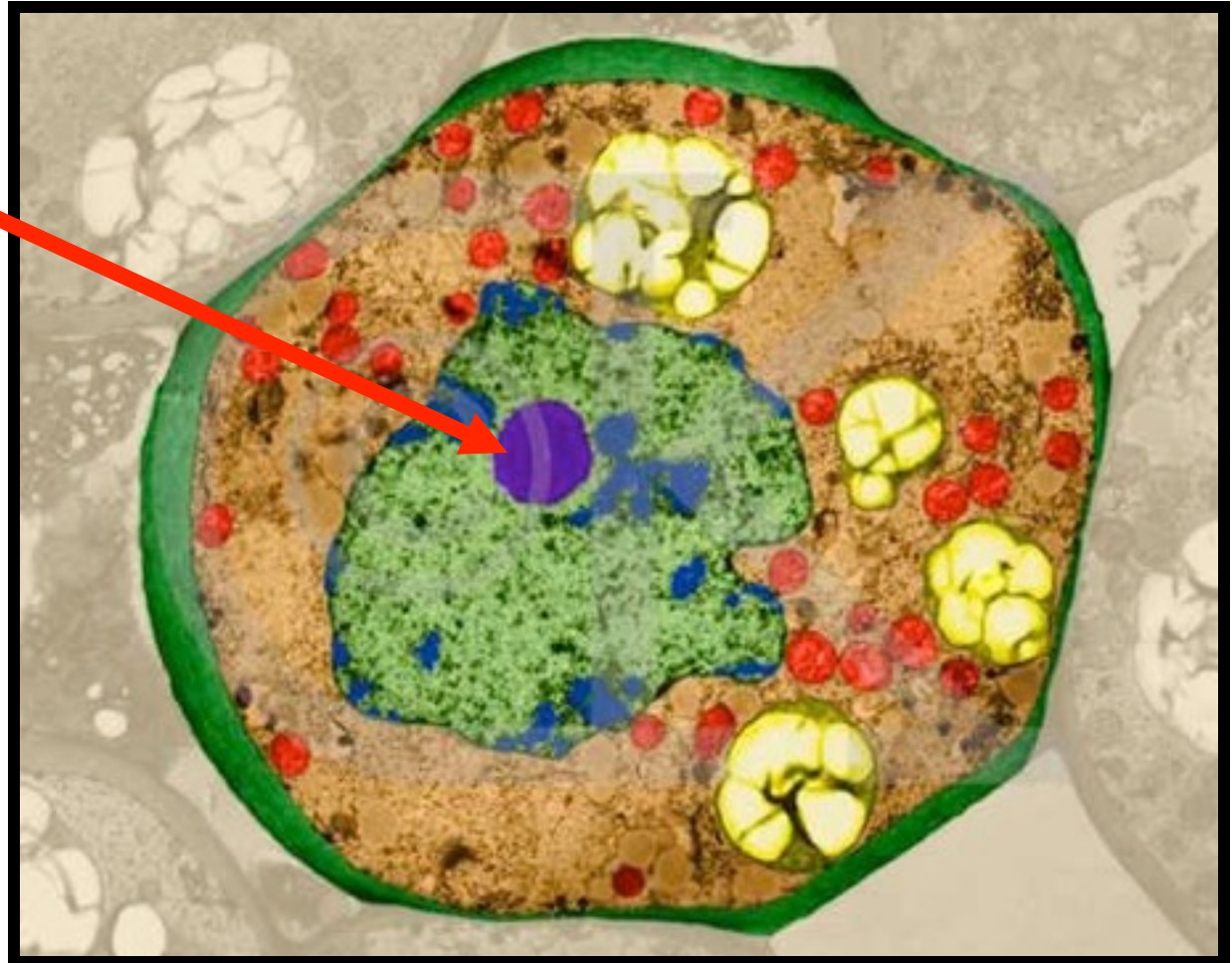


1. Dark granule in the centre of the cell.
2. Stores genetic information
3. Controls cell activities through protein synthesis
4. Controls cell division
5. It is the site of DNA replication and transcription

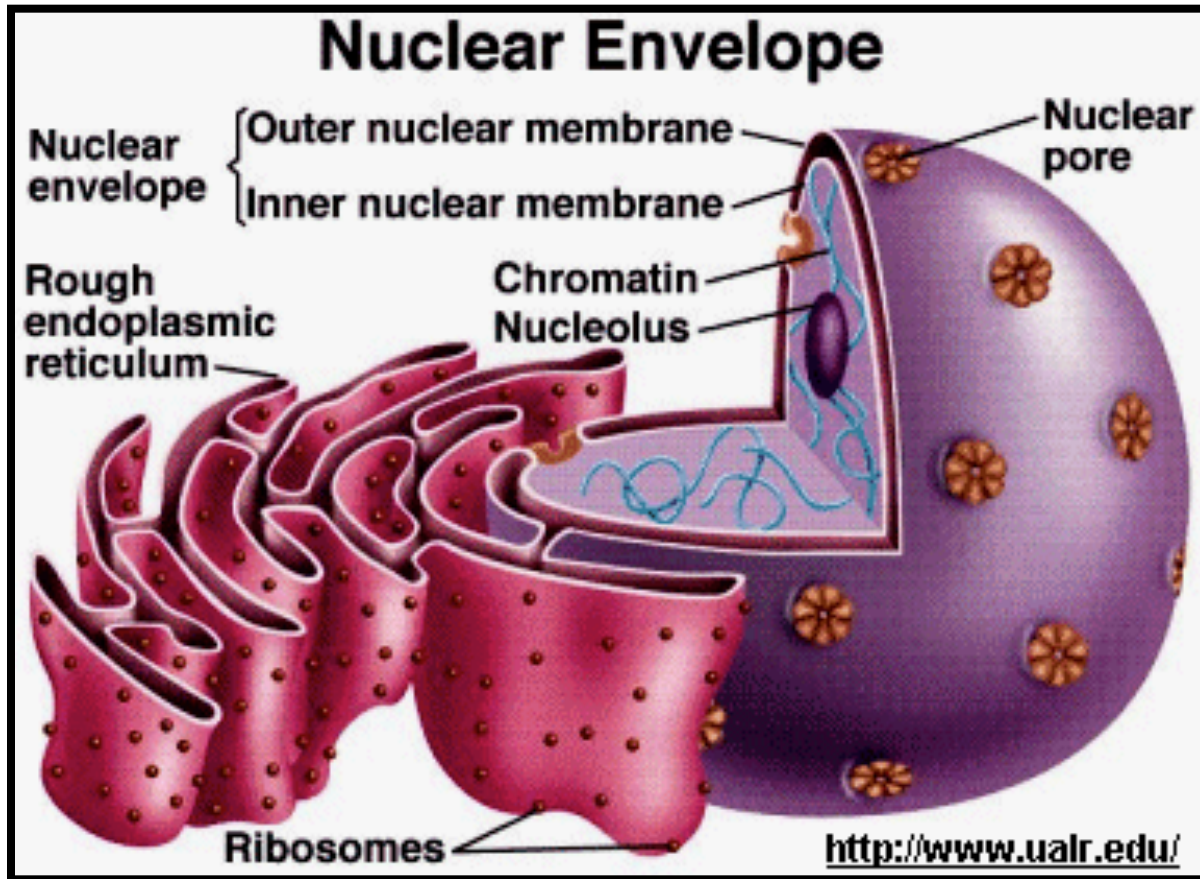


Nucleolus

1. This is the dark stained area in the nucleus.
2. It is made up of RNA.
3. It has no membrane
4. It makes rRNA (ribosomal RNA), which then makes ribosomes.

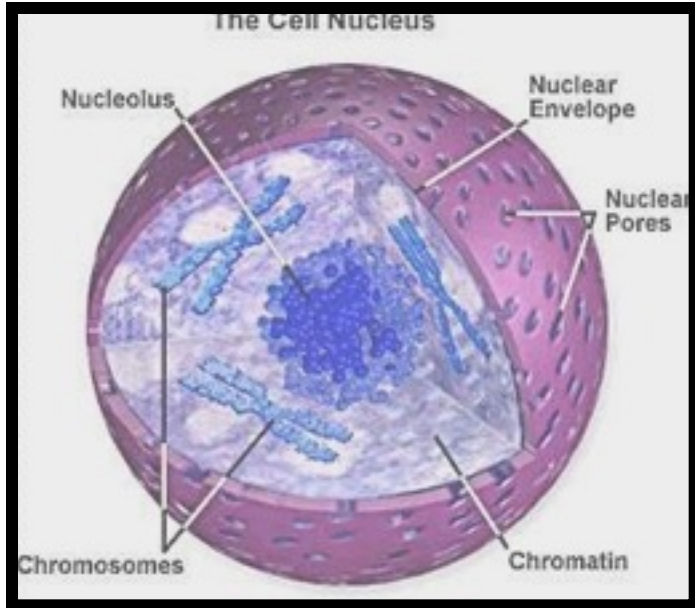
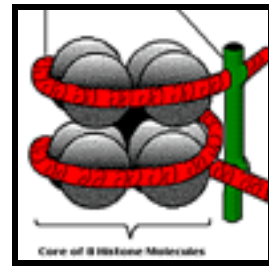


Nuclear Membrane/Envelope

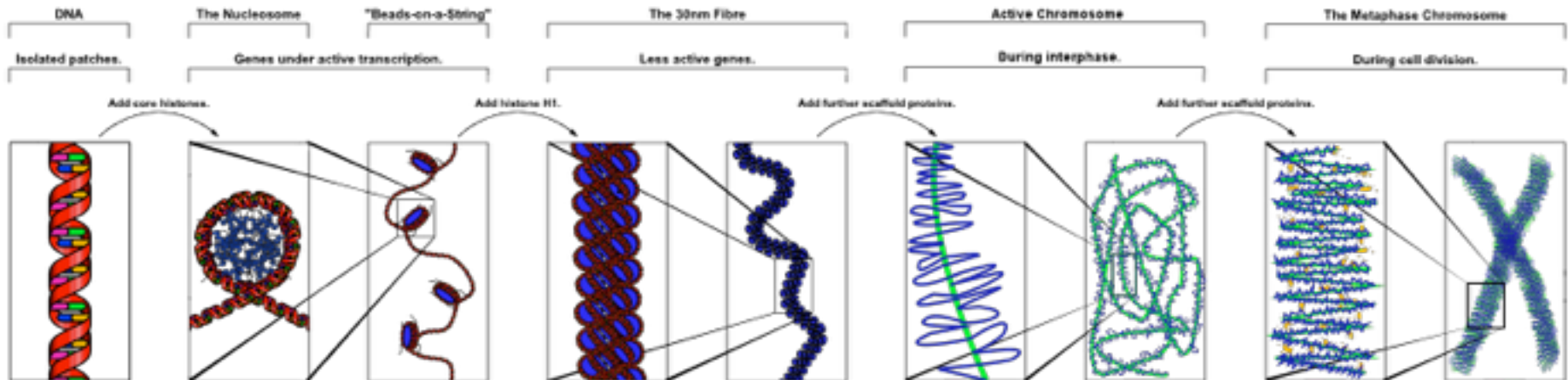


1. A double layer of cell membrane, which contains very large pores.
2. Pores allow RNA and proteins in and out of the nucleus.

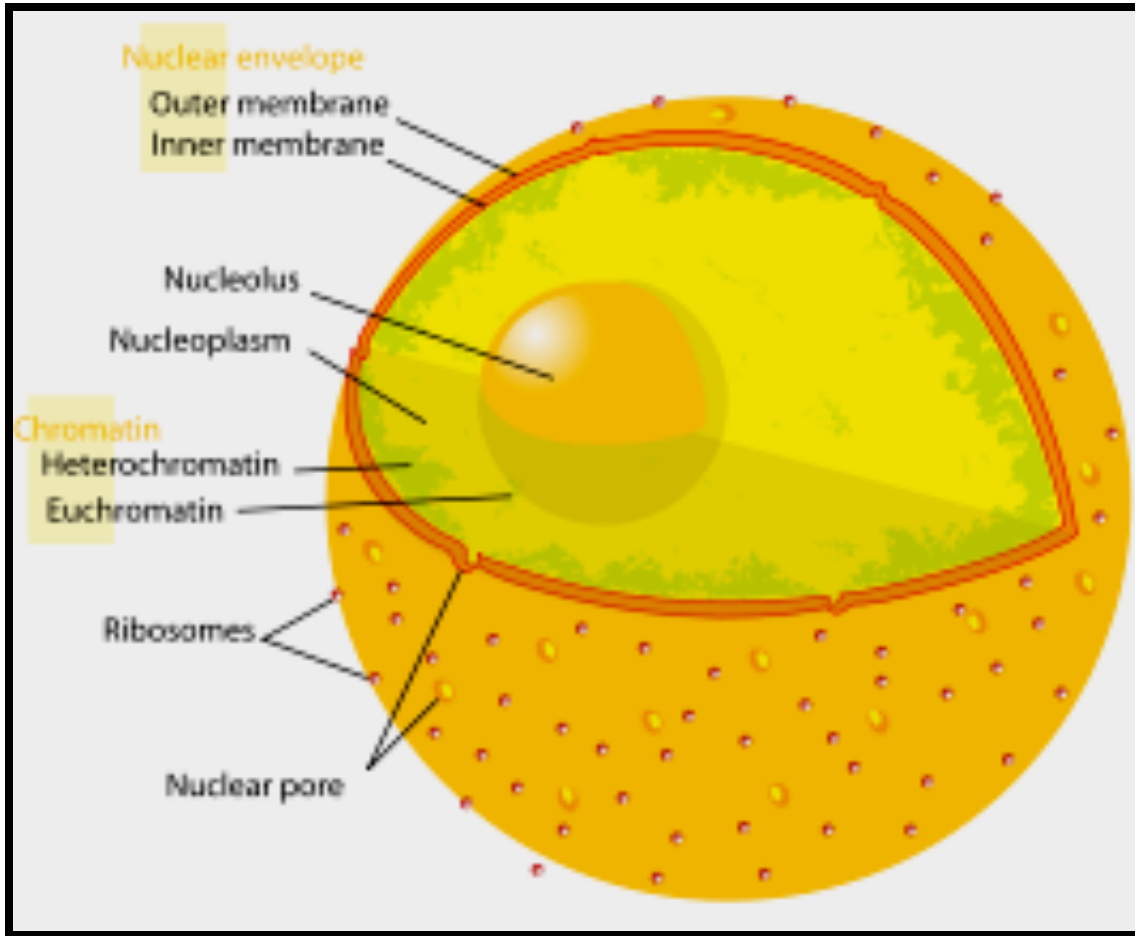
Chromatin



1. Densely coiled DNA wrapped around histone proteins.
2. Contains the blueprint for all proteins in the body
3. Is condensed into chromosomes before cell replication.

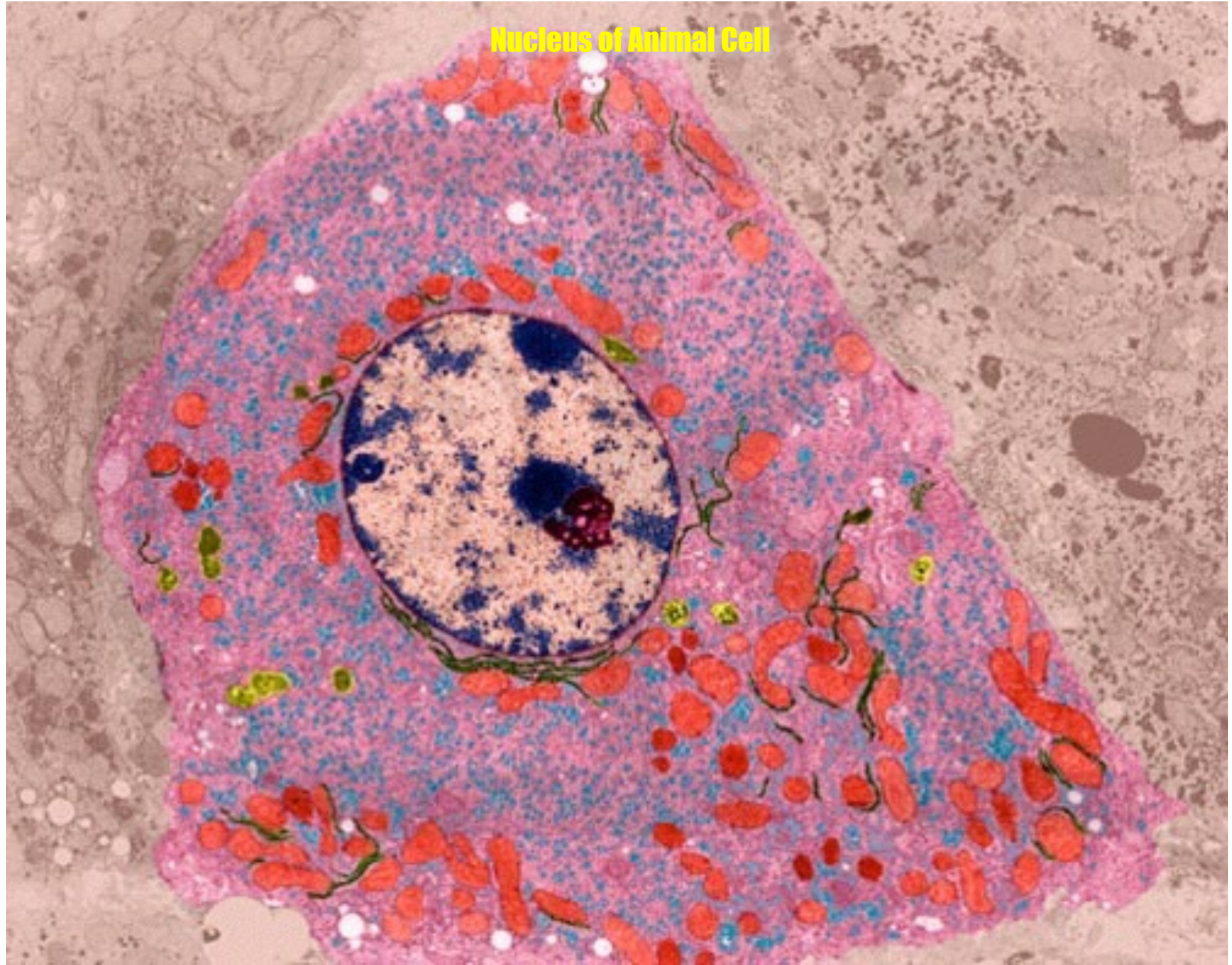


Nucleoplasm

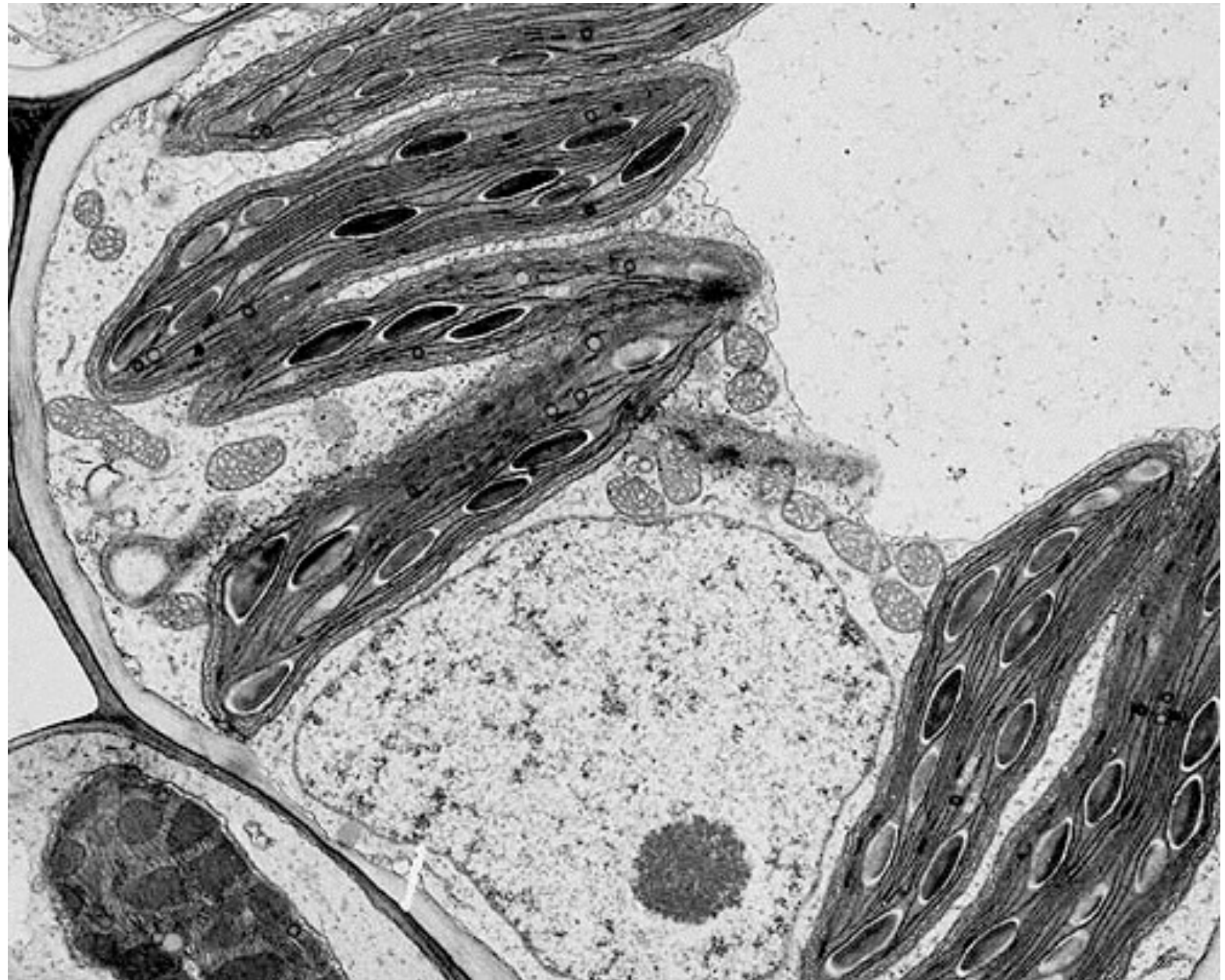


1. This is the cytoplasm of the nucleus.
2. It supports and suspends the contents of the nucleus.

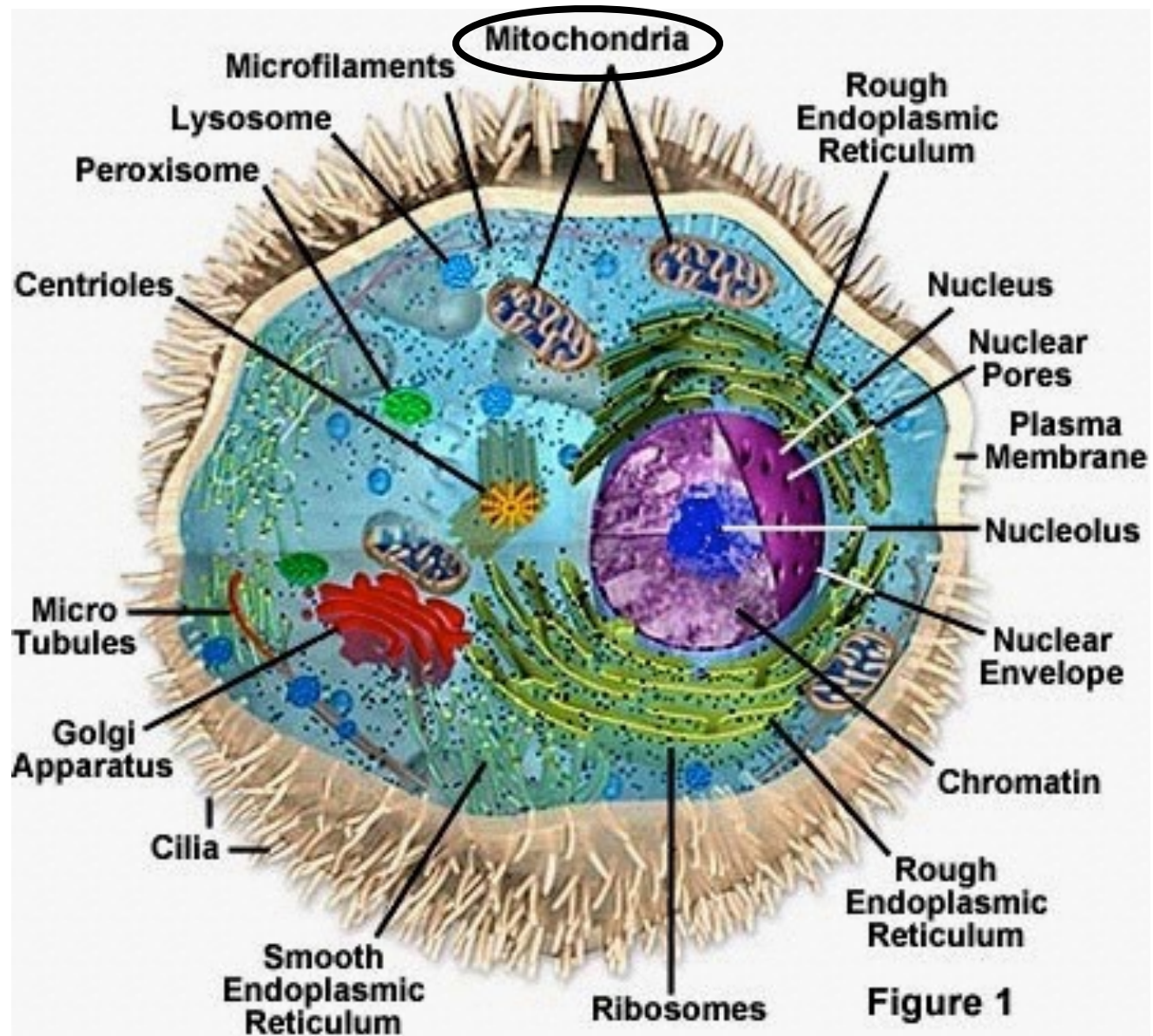
Nucleus of Animal Cell



Nucleus of Plant Cell



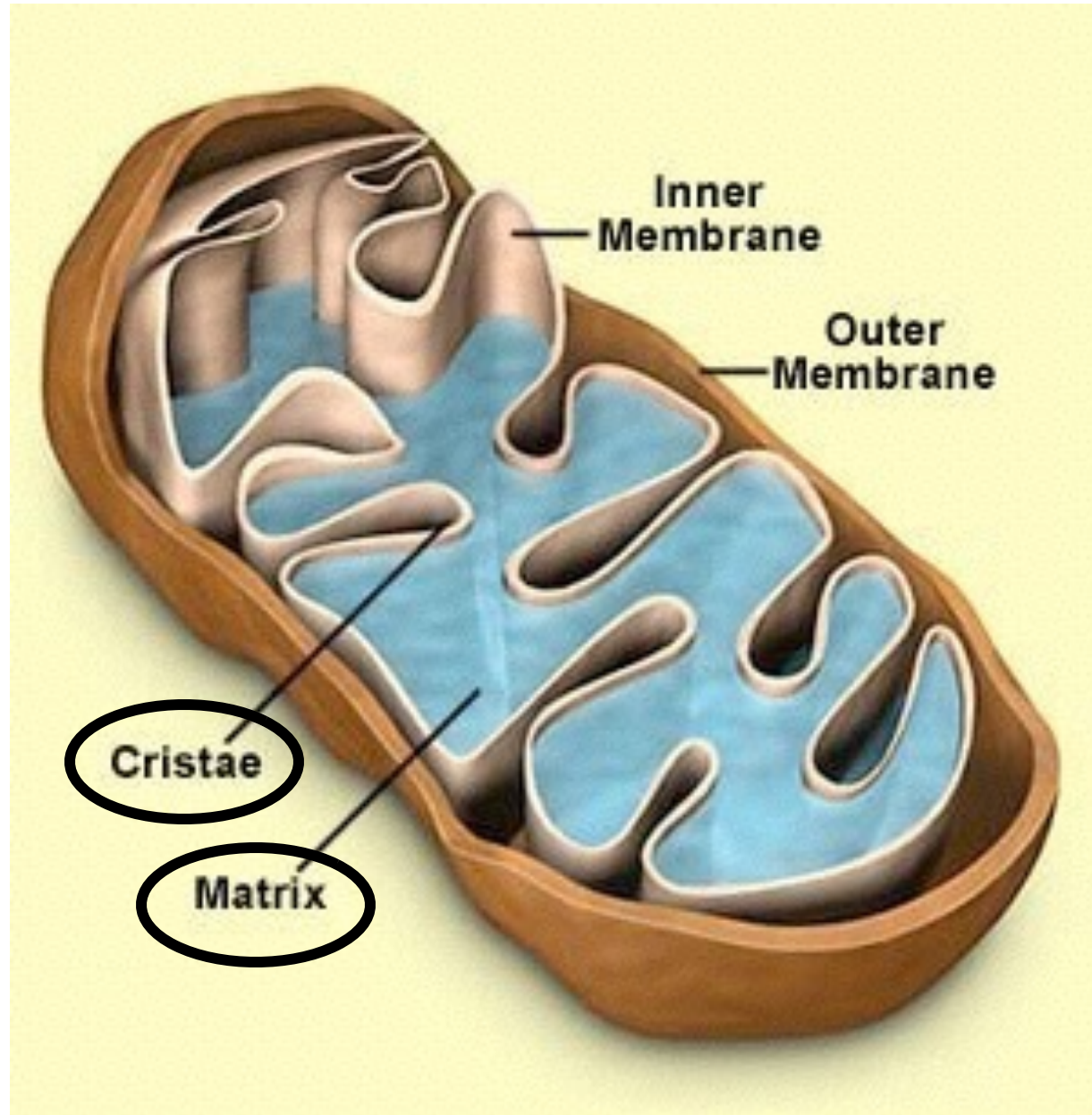
ORGANELLES



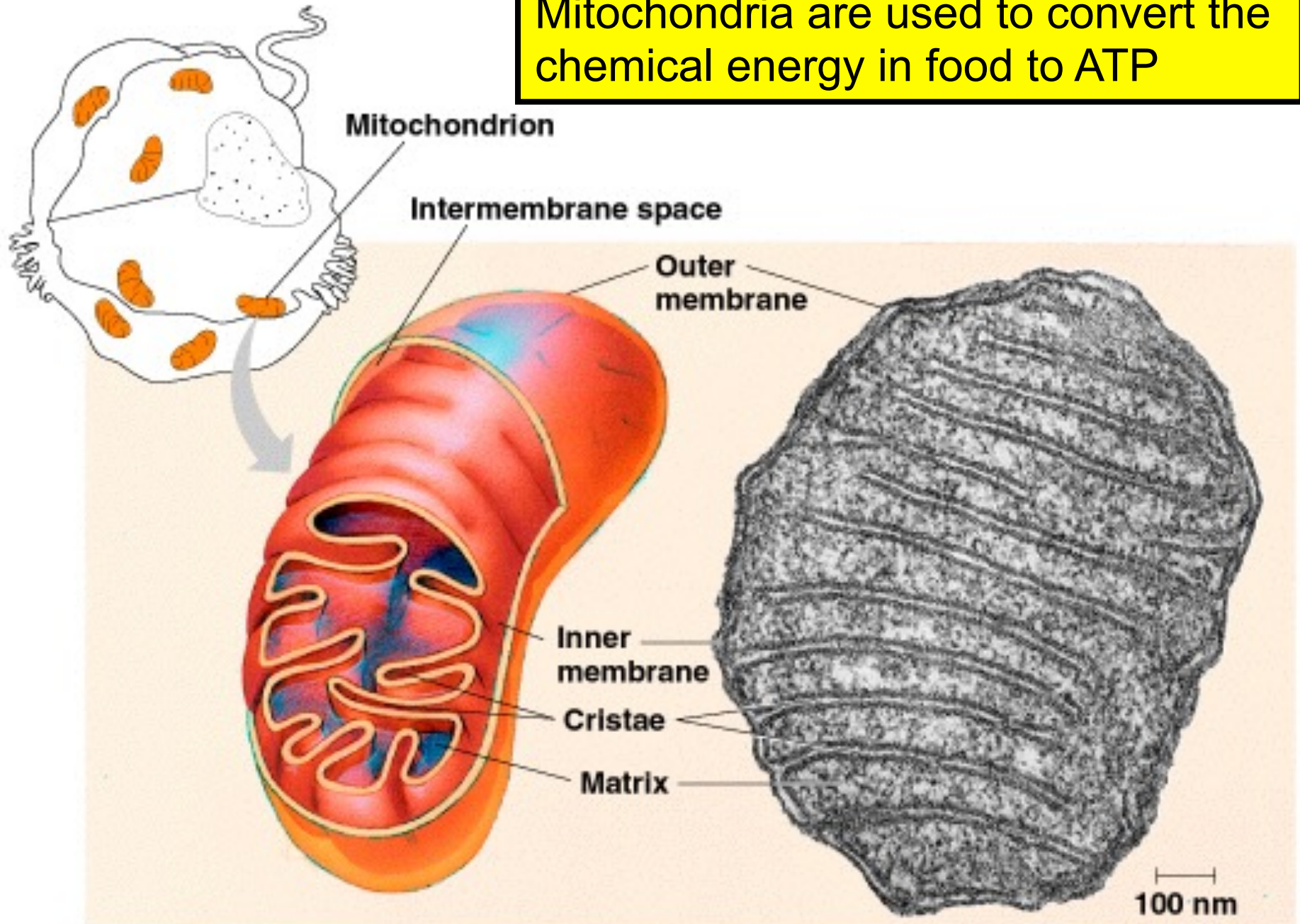


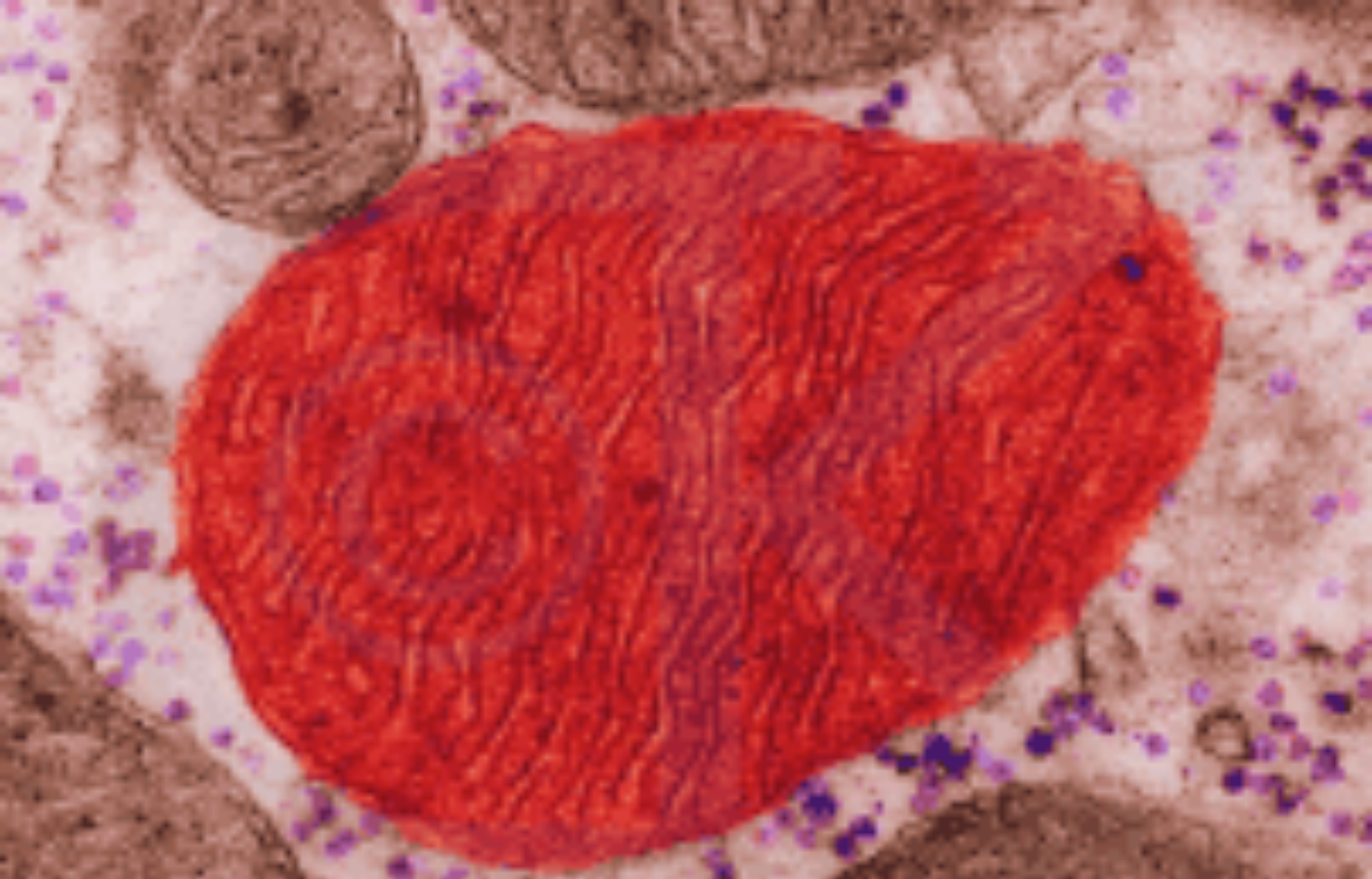
MITOCHONDRIA

1. This is the **FURNACE** of the cell.
2. It has a double membrane. Inner membrane is very folded = **CRISTAE** (increased surface area).
3. Mitochondria have their own DNA.



Mitochondria are used to convert the chemical energy in food to ATP

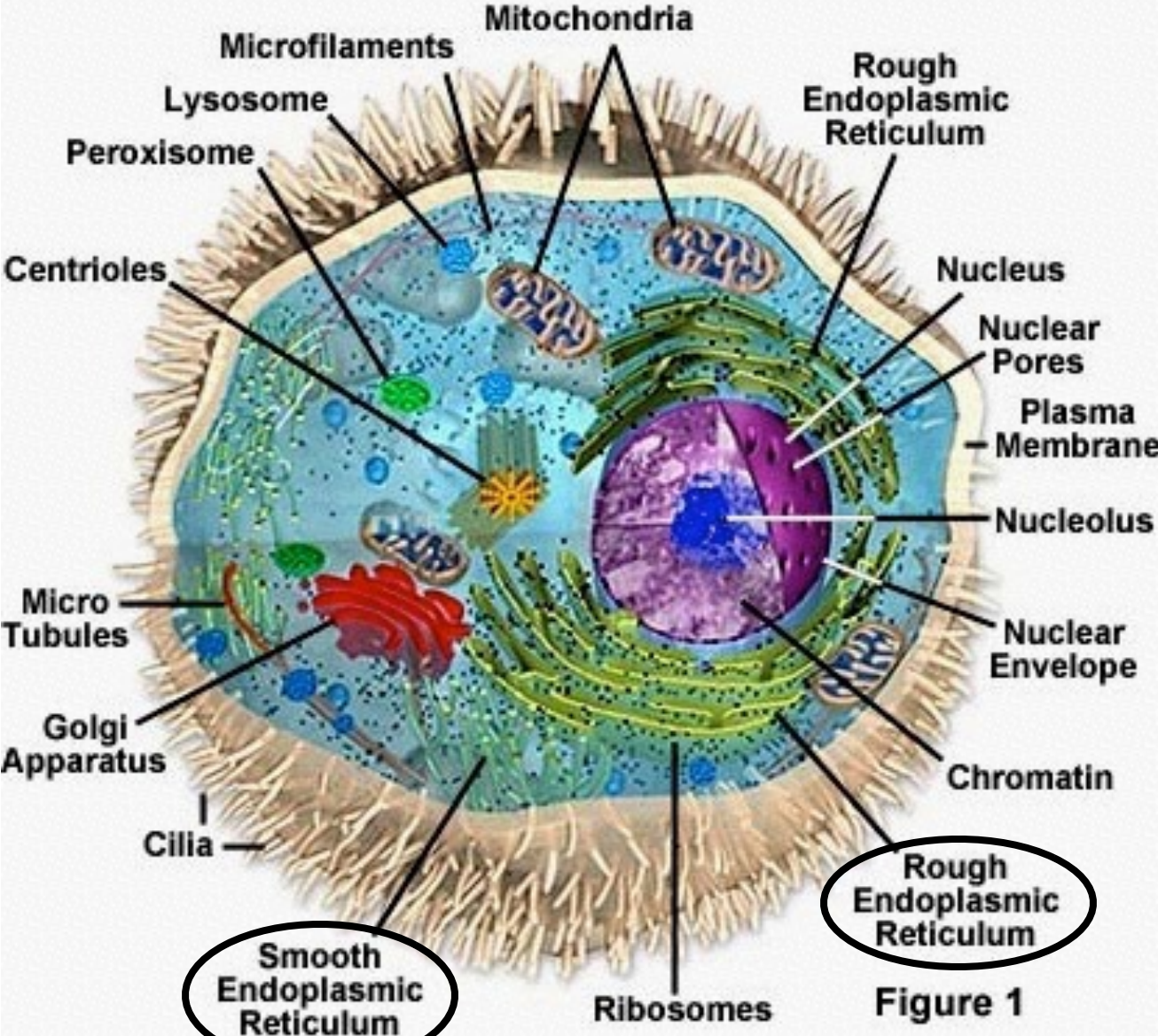




Mitochondria performs **CELLULAR RESPIRATION:**



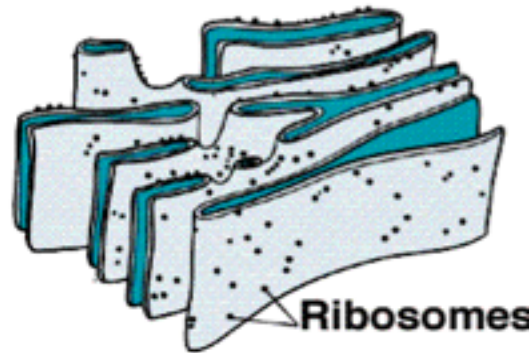
ORGANELLES



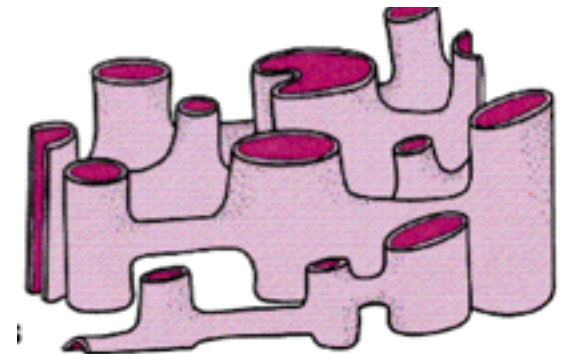
ENDOPLASMIC RETICULUM

This is an extensive network of internal sheets of cell membrane. The ER connects the nuclear membrane to the plasma membrane. It is a transport system.

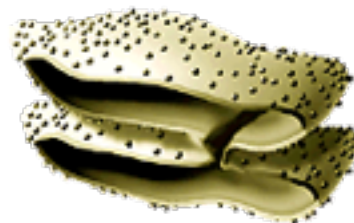
There are two types:



Rough ER




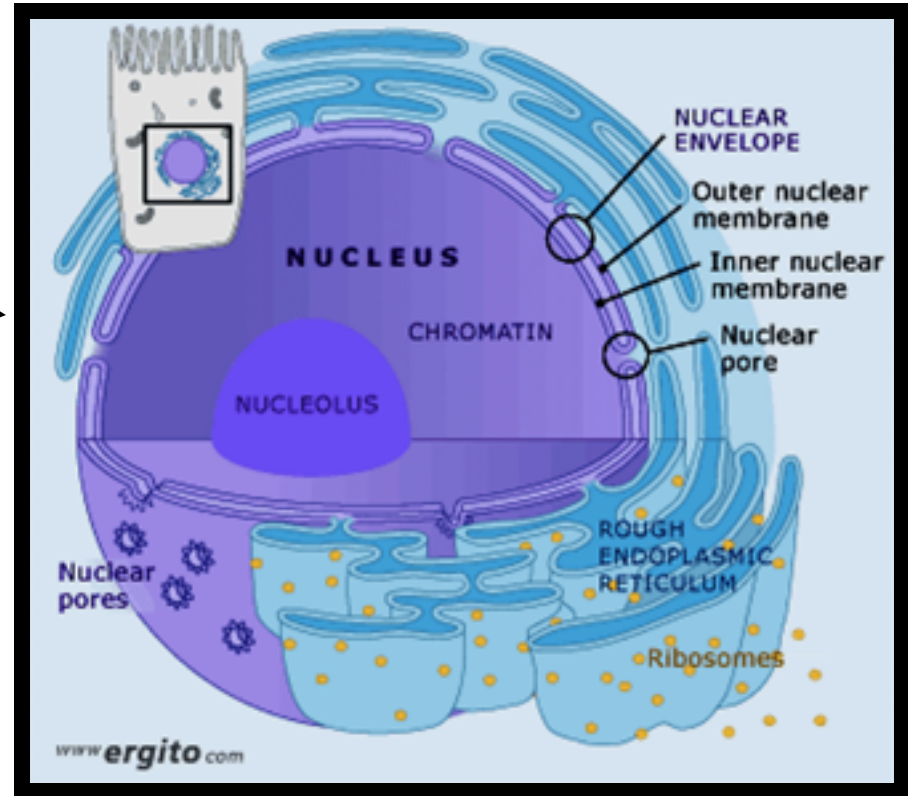
Smooth ER

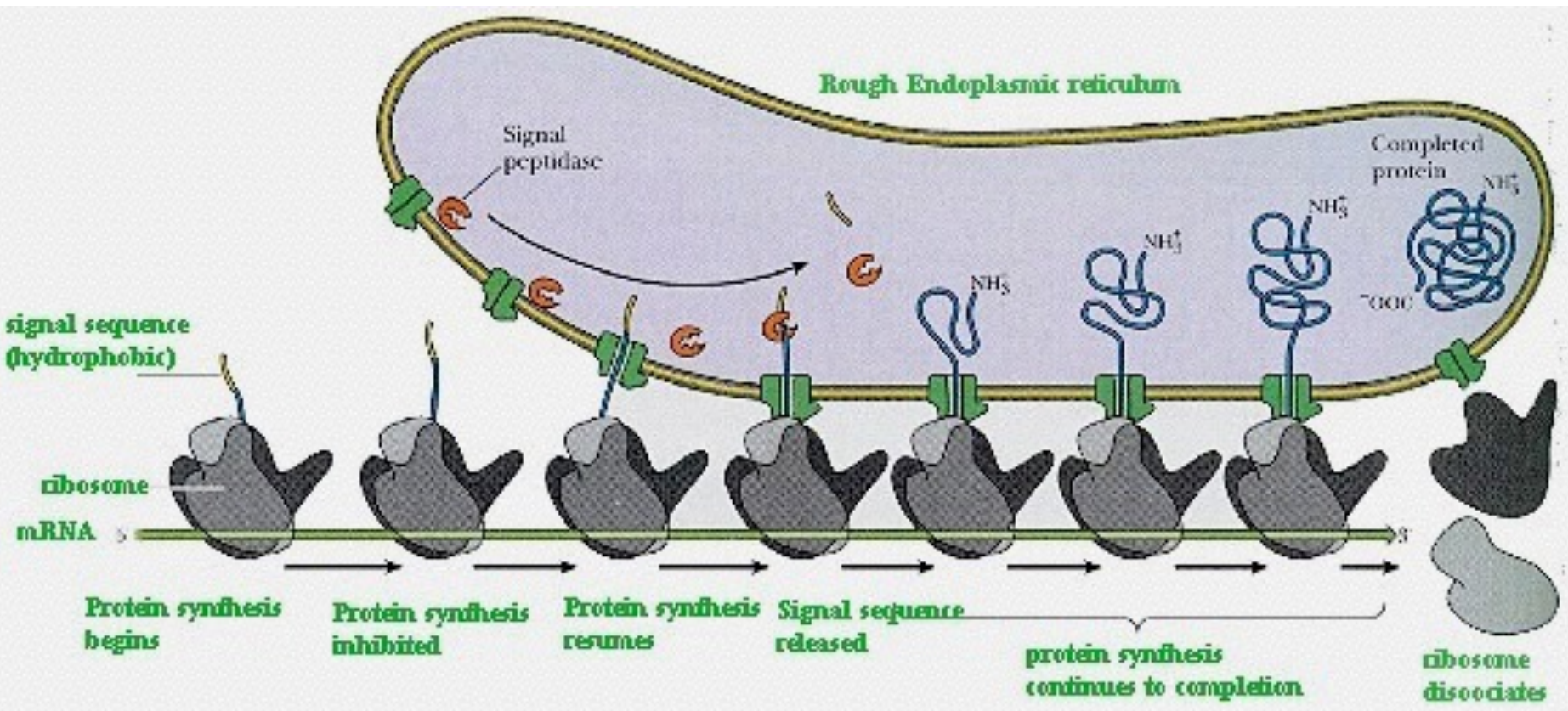


ROUGH ENDOPLASMIC RETICULUM

ROUGH ER:

- Has attached ribosomes.
- Usually connected with the nuclear membrane. 
- Ribosomes make proteins and then place them in the rER
- Proteins are sometimes modified here
- The rER packages proteins in a vesicle and sends them to the Golgi Body.





signal sequence (hydrophobic)

ribosome

mRNA

Rough Endoplasmic reticulum

Signal peptidase

Completed protein

Protein synthesis begins

Protein synthesis inhibited

Protein synthesis resumes

Signal sequence released

protein synthesis continues to completion

ribosome dissociates

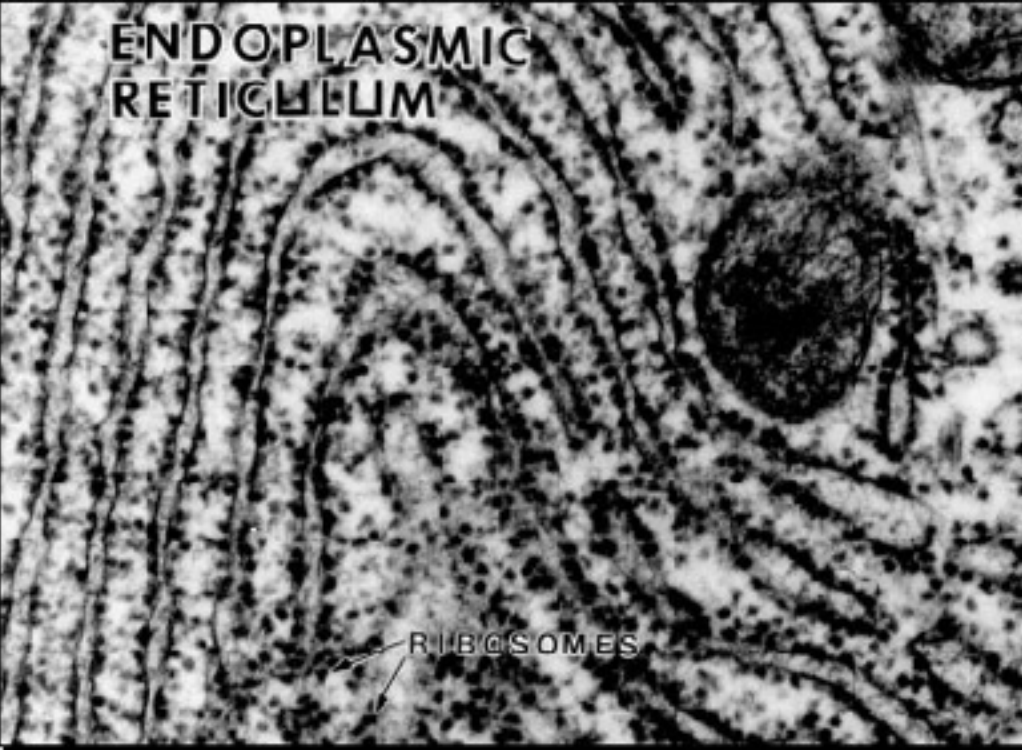
NH₂

NH₂

NH₂

COOH

NH₂



ROUGH ER

R.E.R.

SMOOTH ENDOPLASMIC RETICULUM

SMOOTH ER:

- Has no attached ribosomes.
- Makes lipids and steroids.
- Also detoxifies harmful material or waste products
- You'll find a lot of sER in liver cells and glands that make hormones.



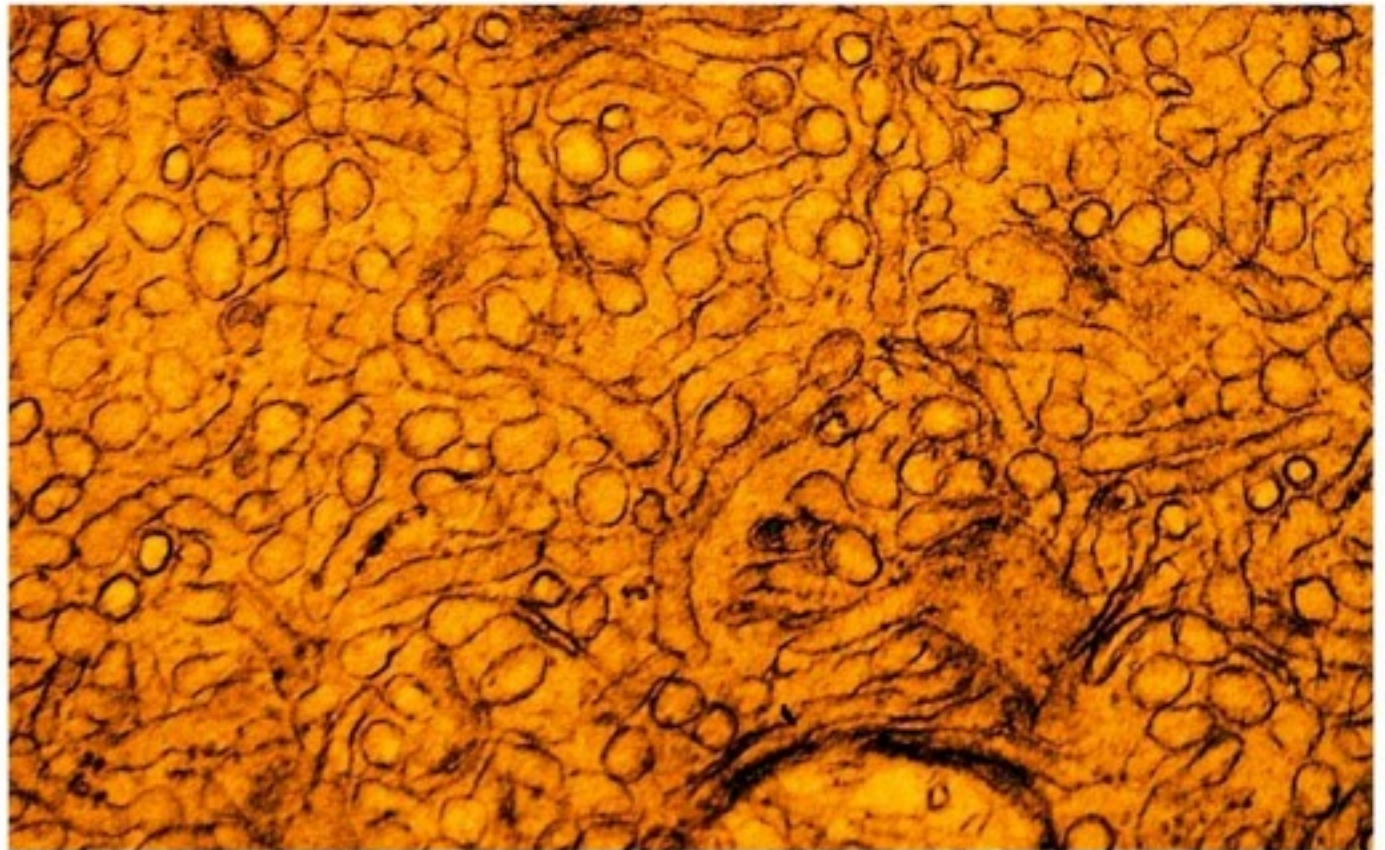
Smooth
ER

S.E.R.

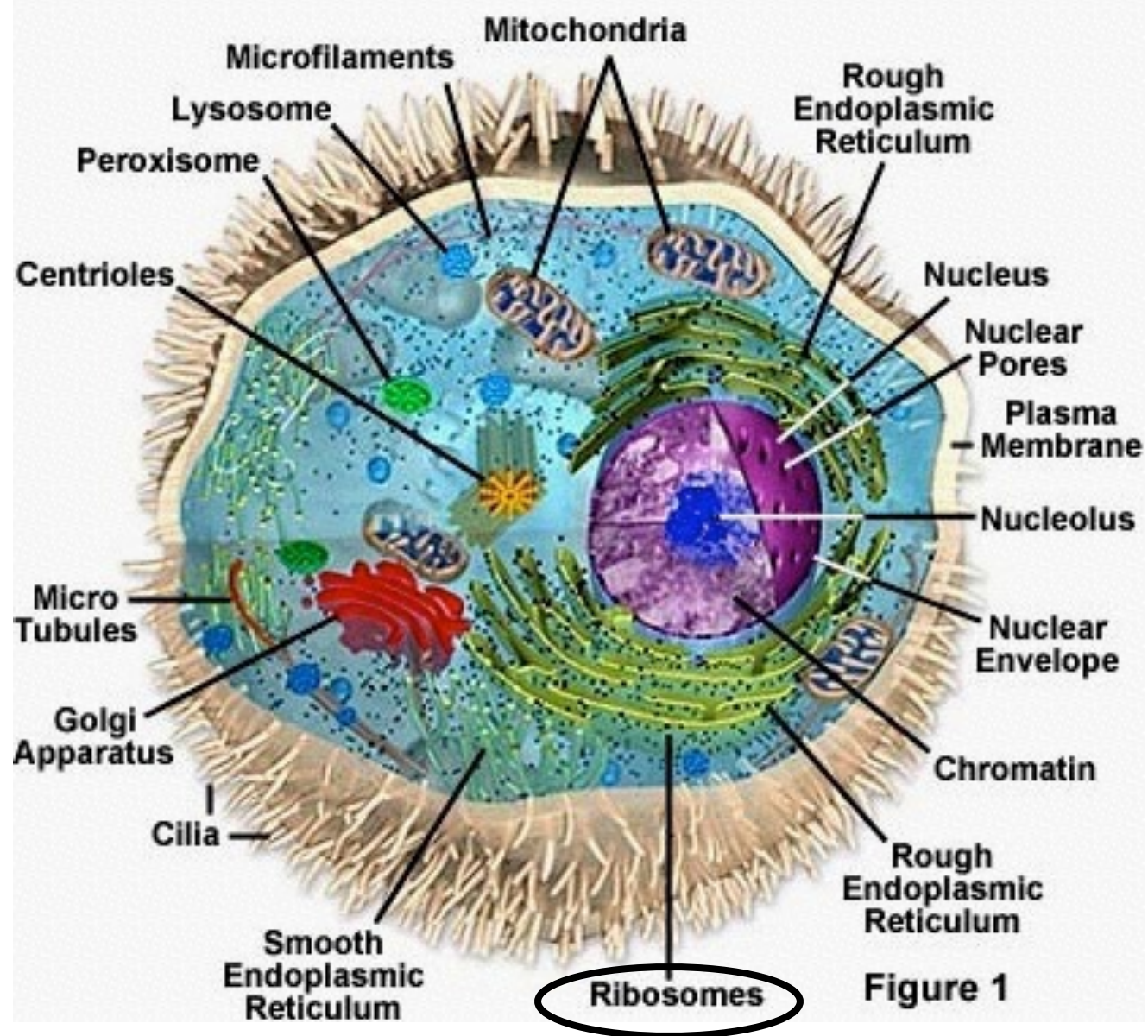


smooth ER

Smooth ER (no ribosomes attached)

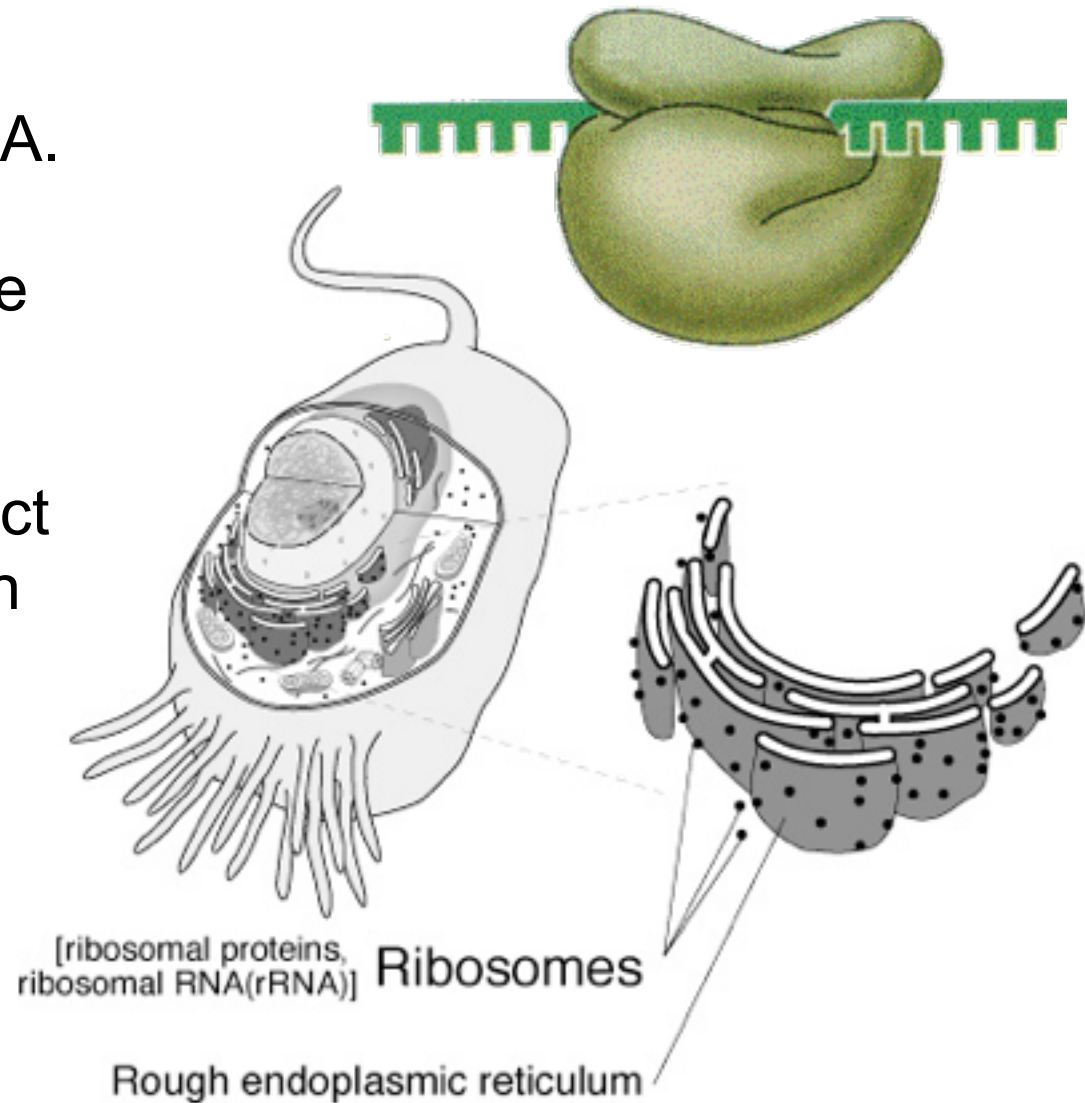
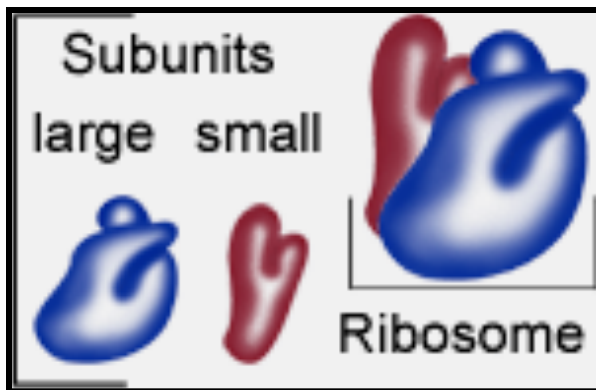


ORGANELLES



RIBOSOME

1. These are small dark granules made of rRNA.
2. Ribosomes are the site of protein synthesis.
3. They ensure the correct order of amino acids in the protein chain.

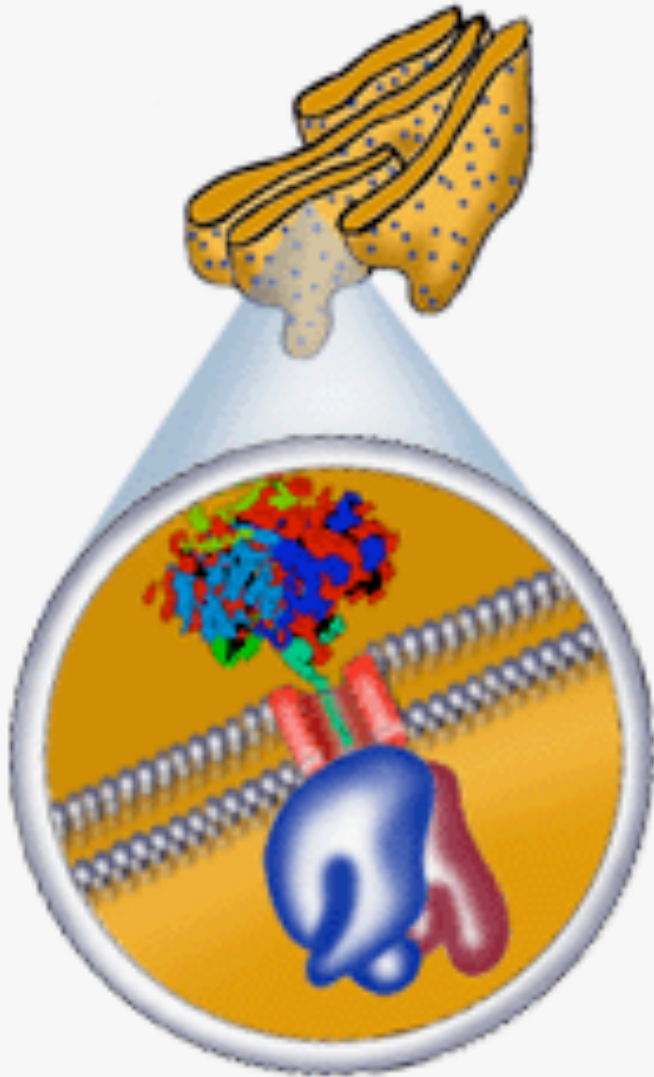


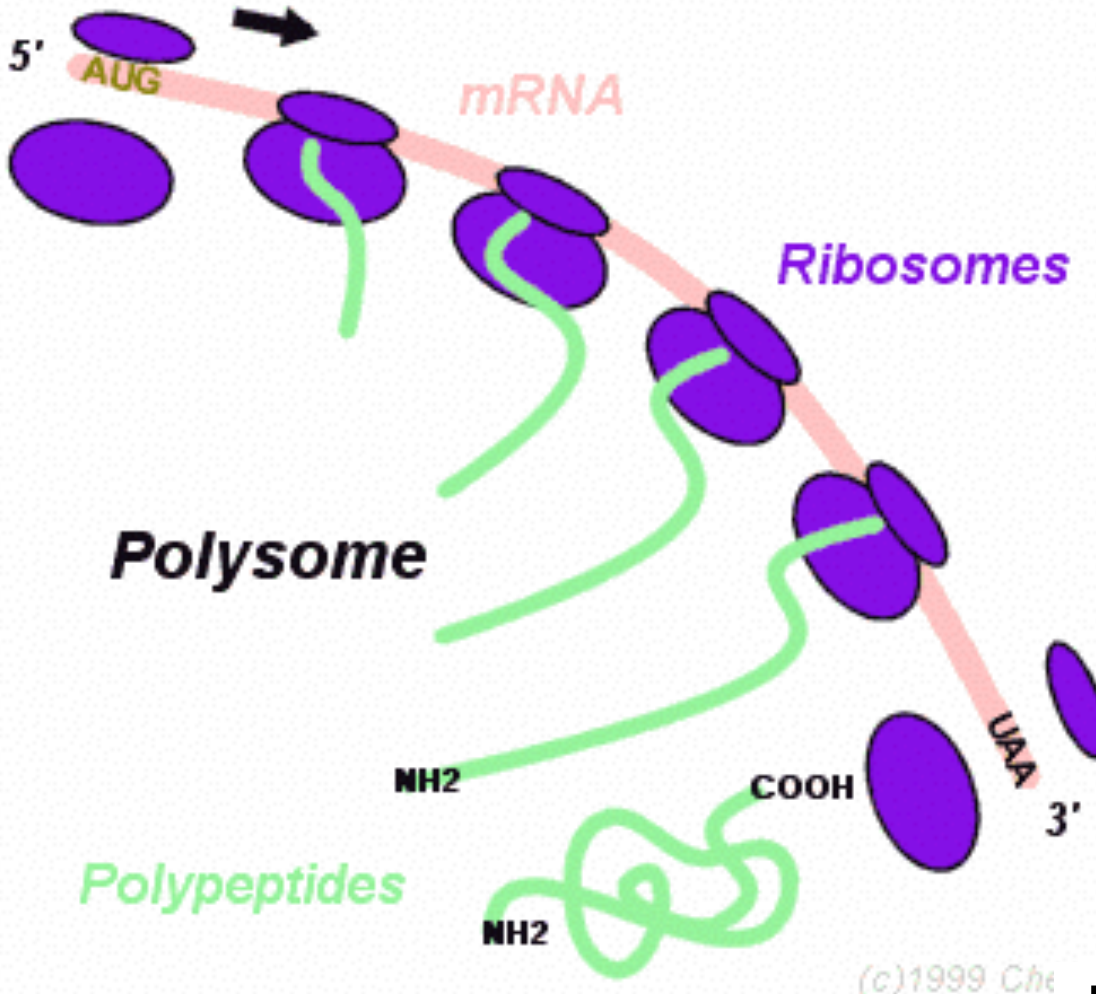
hybrid

medical animation



Usually attached to the rough ER, so proteins produced can be easily exported (sent out of the cell).

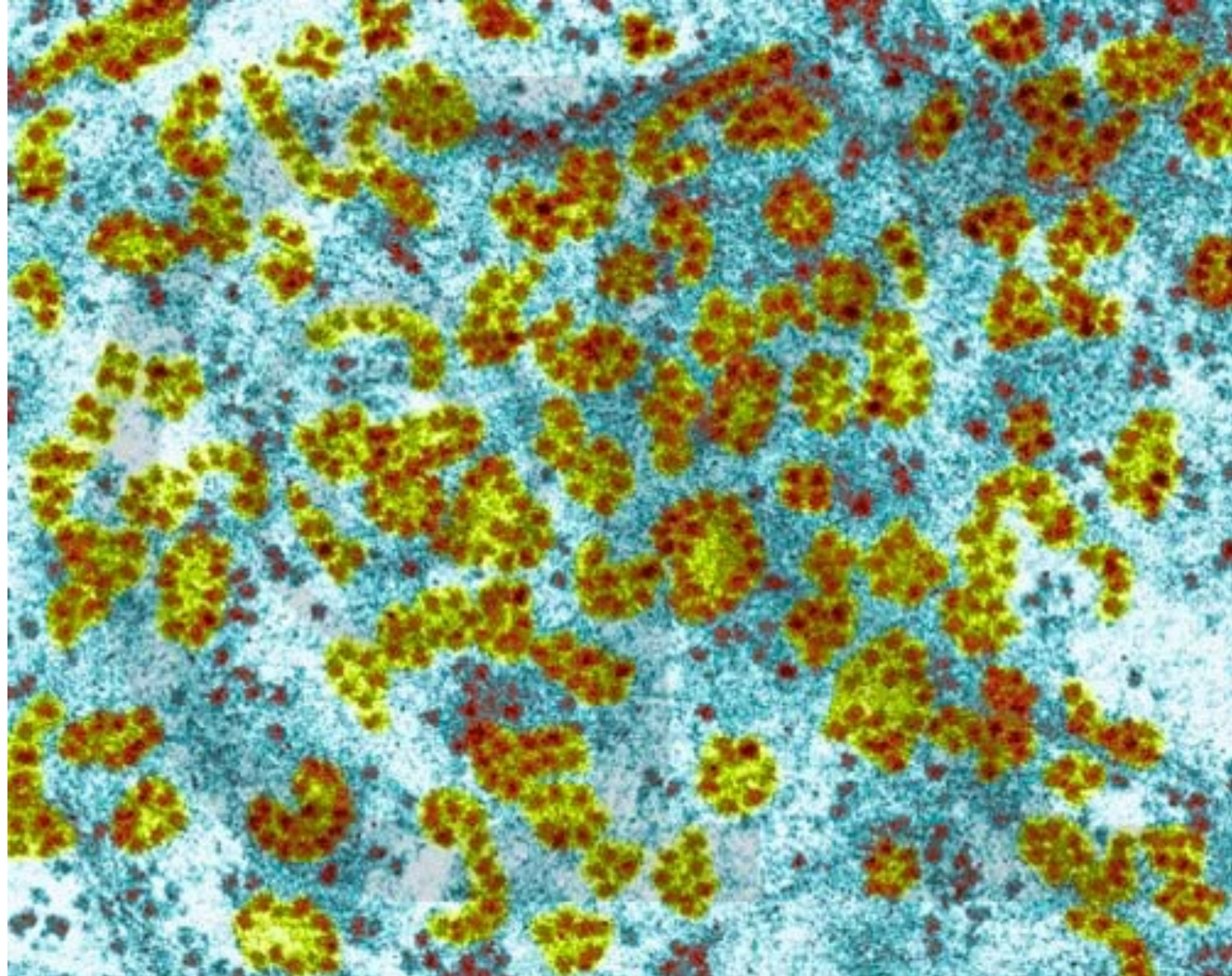




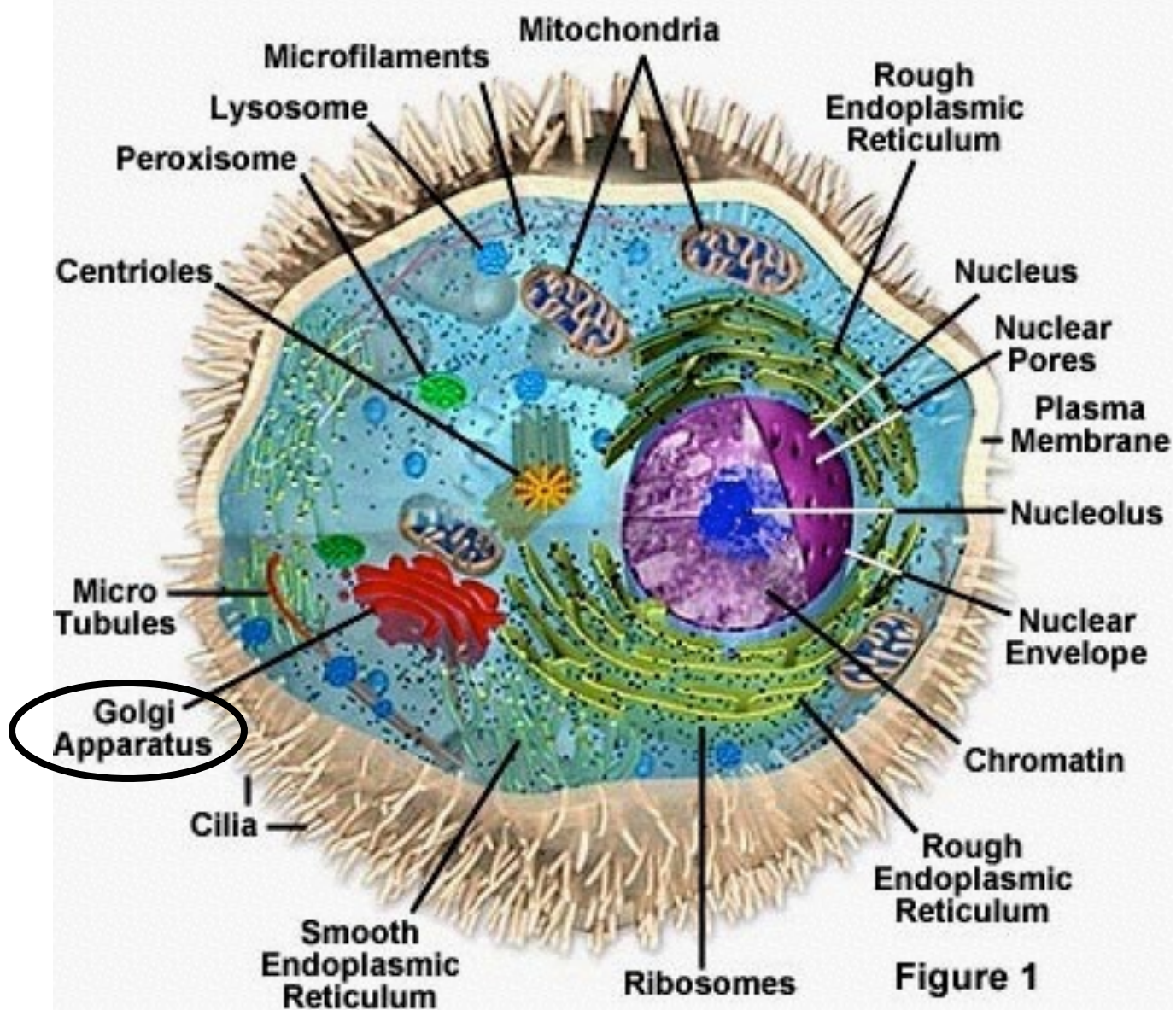
POLYSOME

Free floating ribosomes join up to make many copies of the same protein.

Polysomes produce proteins to be used inside the cell.

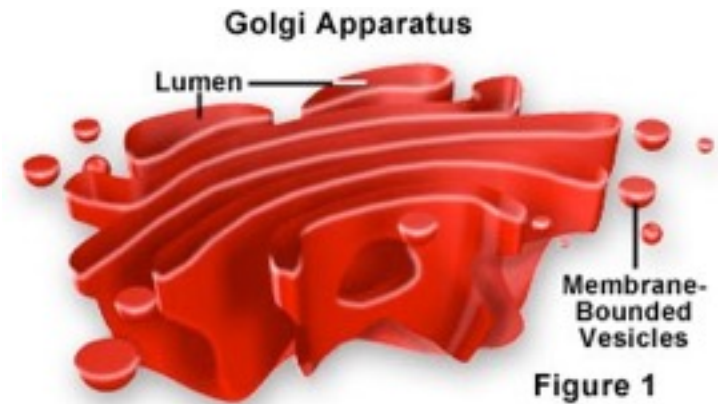


ORGANELLES



GOLGI APPARATUS

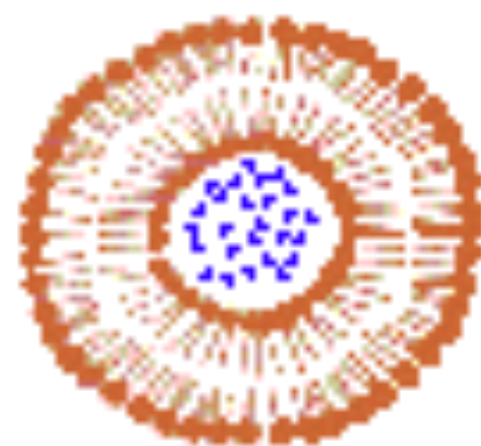
1. These are made up of flattened saccules of cell membrane, which are stacked loosely on top of each other.
2. One side faces the ER and the other faces the plasma membrane.
3. There are usually vesicles at the edges of the Golgi.
4. Their function is to receive, modify, and temporarily store proteins and fats from the rough and smooth ER.



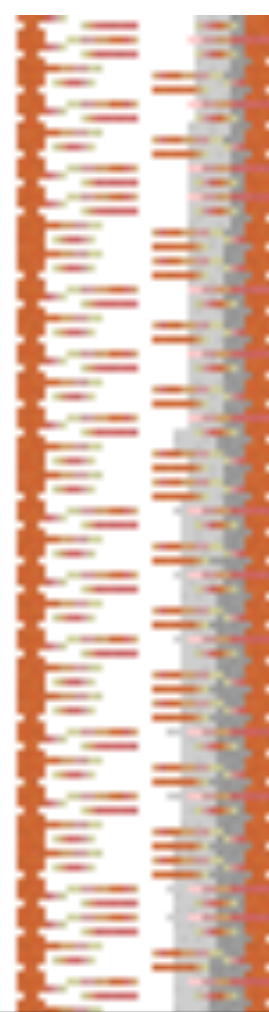


These proteins are packaged into vesicles which pinch off from the edges, and are distributed within the cell or shipped to the cell membrane for excretion.



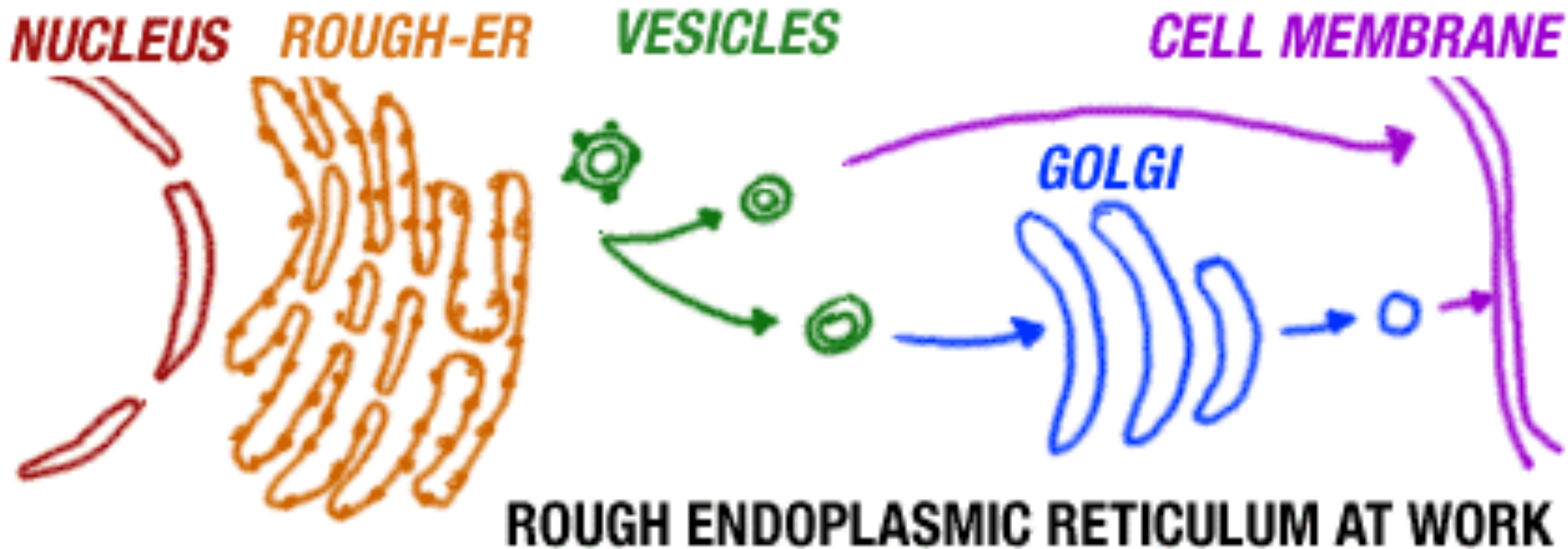


VESICLE

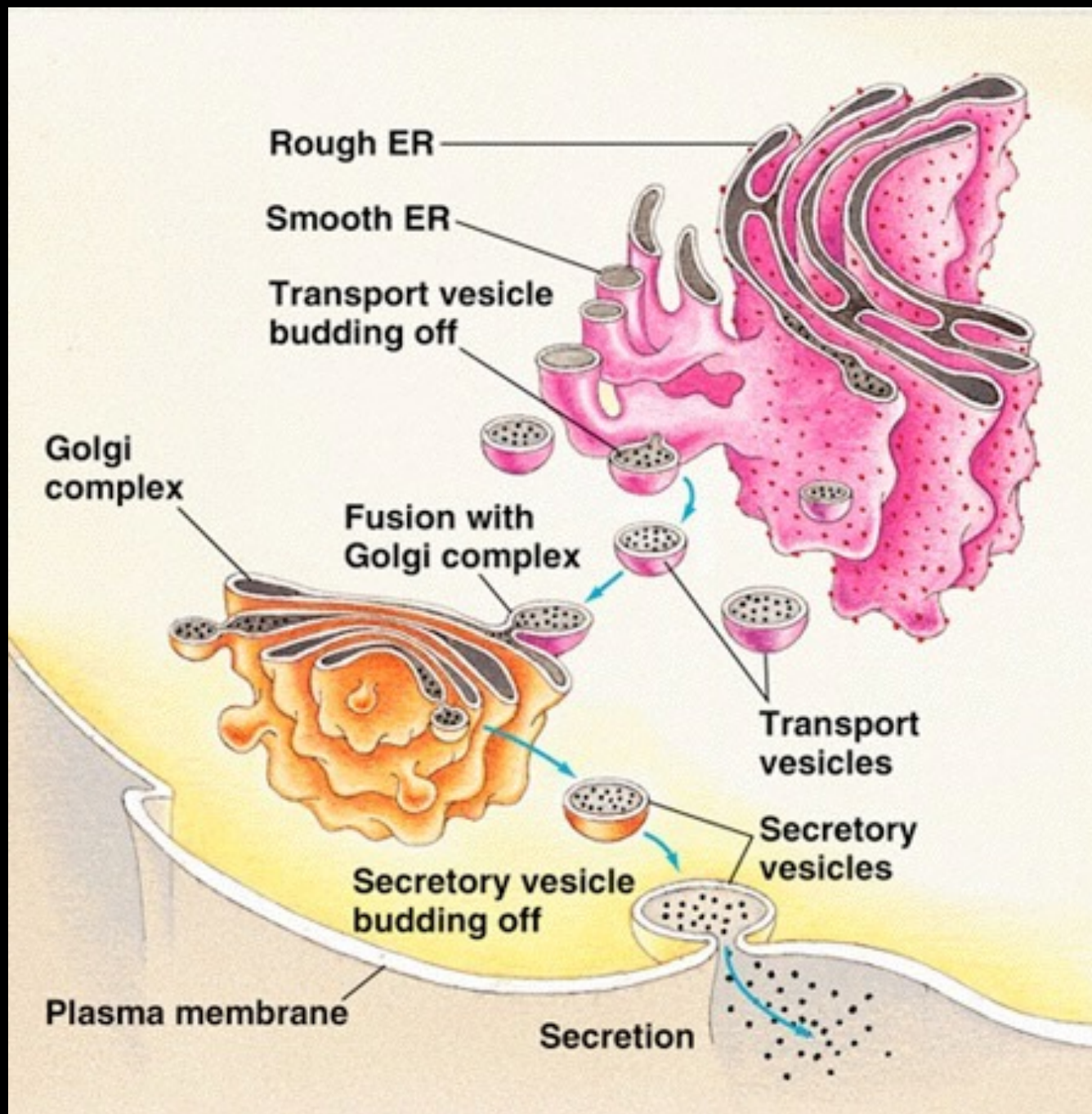


PLASMA
MEMBRANE

relationships



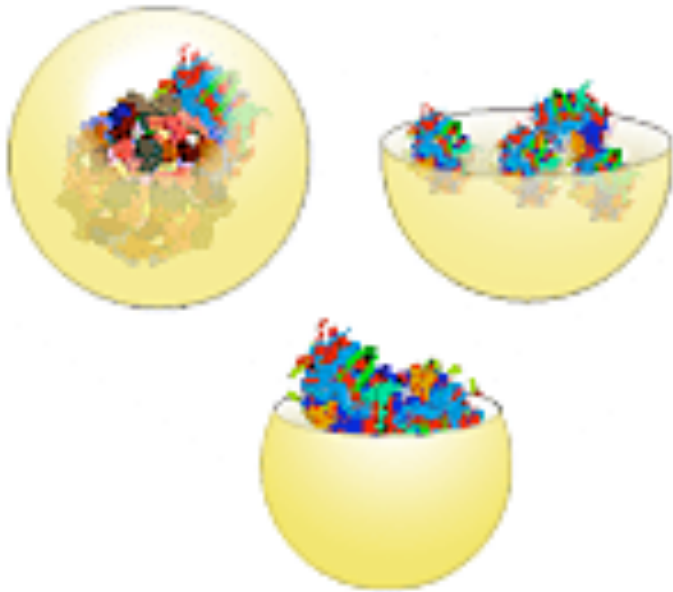
DNA copies a gene as RNA	RNA moves through pore and attaches to ribosome to make protein	Protein put into RER, then sent to Golgi in a vesicle	Golgi modifies protein, stores it until needed, and sends it to PM in a vesicle.	Protein released at the Plasma Membrane via exocytosis
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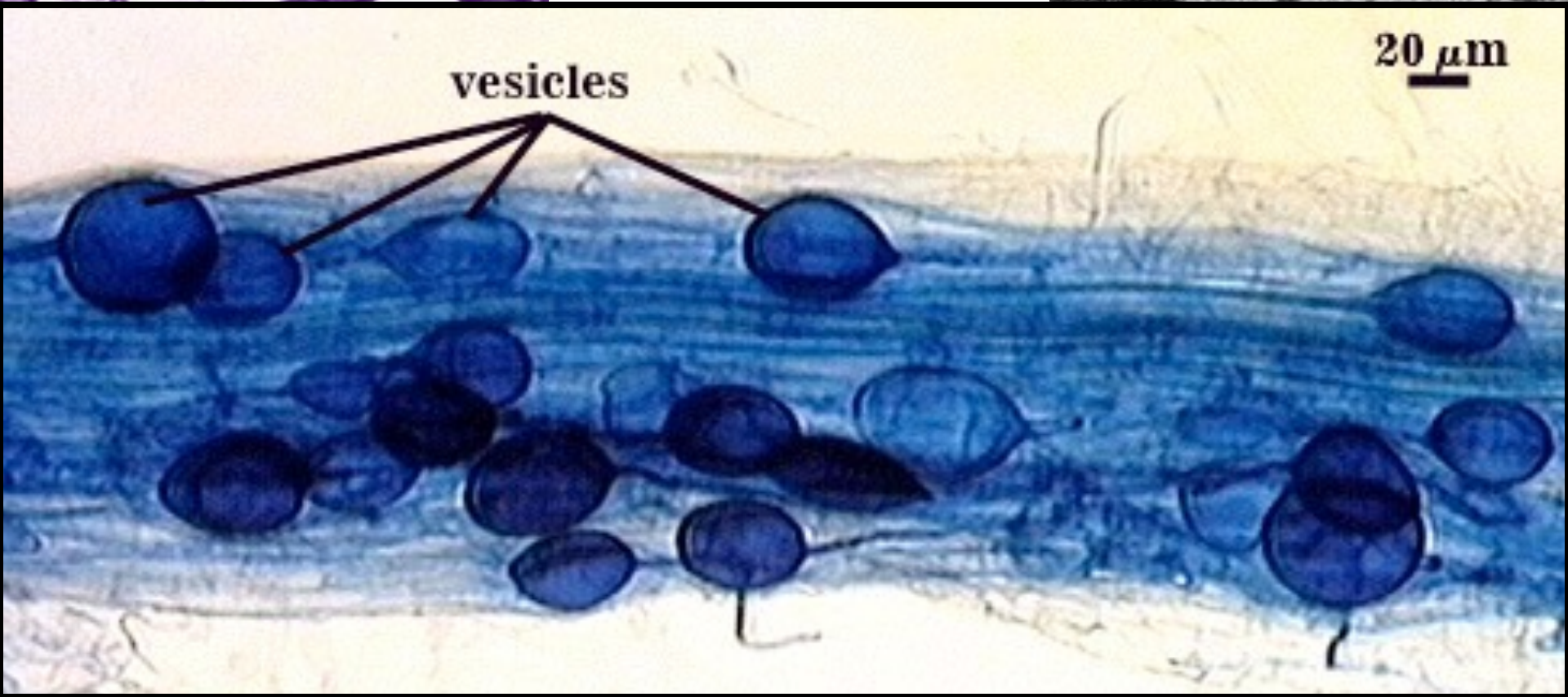
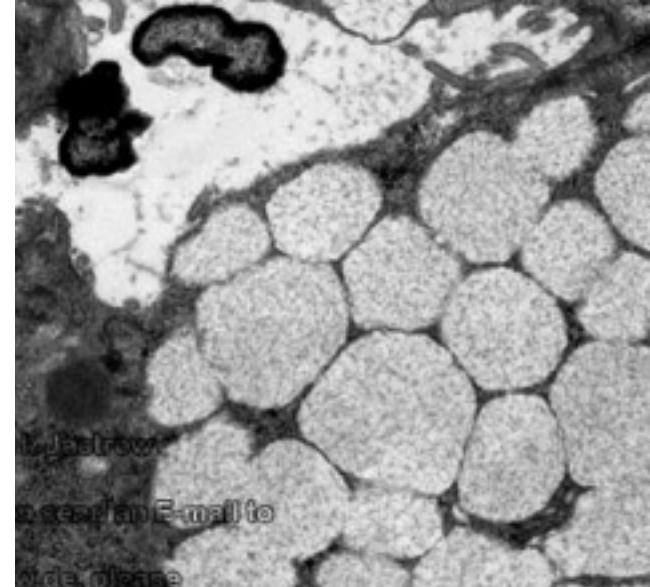
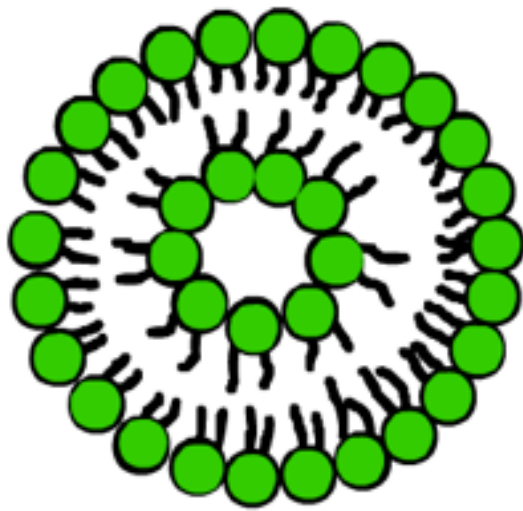
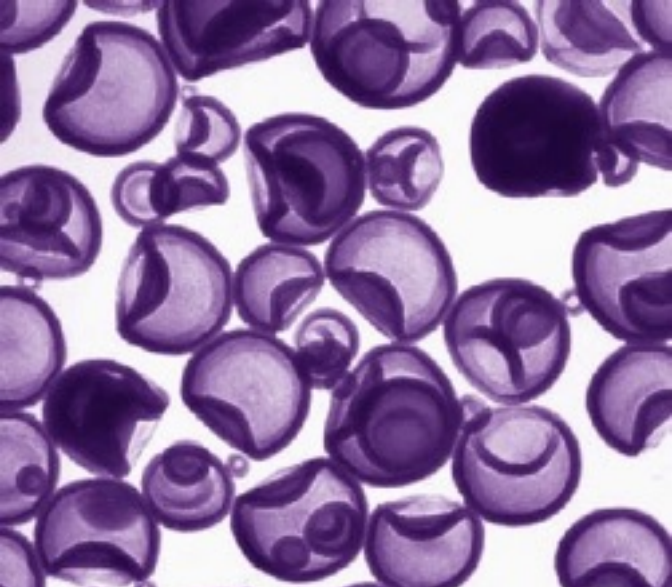


VESSICLES



1. These are the storage sacs of the cell membrane.
2. Vesicles are smaller and are formed by pinocytosis (cell drinking) – usually made by Golgi body or from infoldings of the cell membrane.
3. They are used to move substances around the cell that need to be separate from the cytoplasm.
4. Stores food, water, and/or waste.



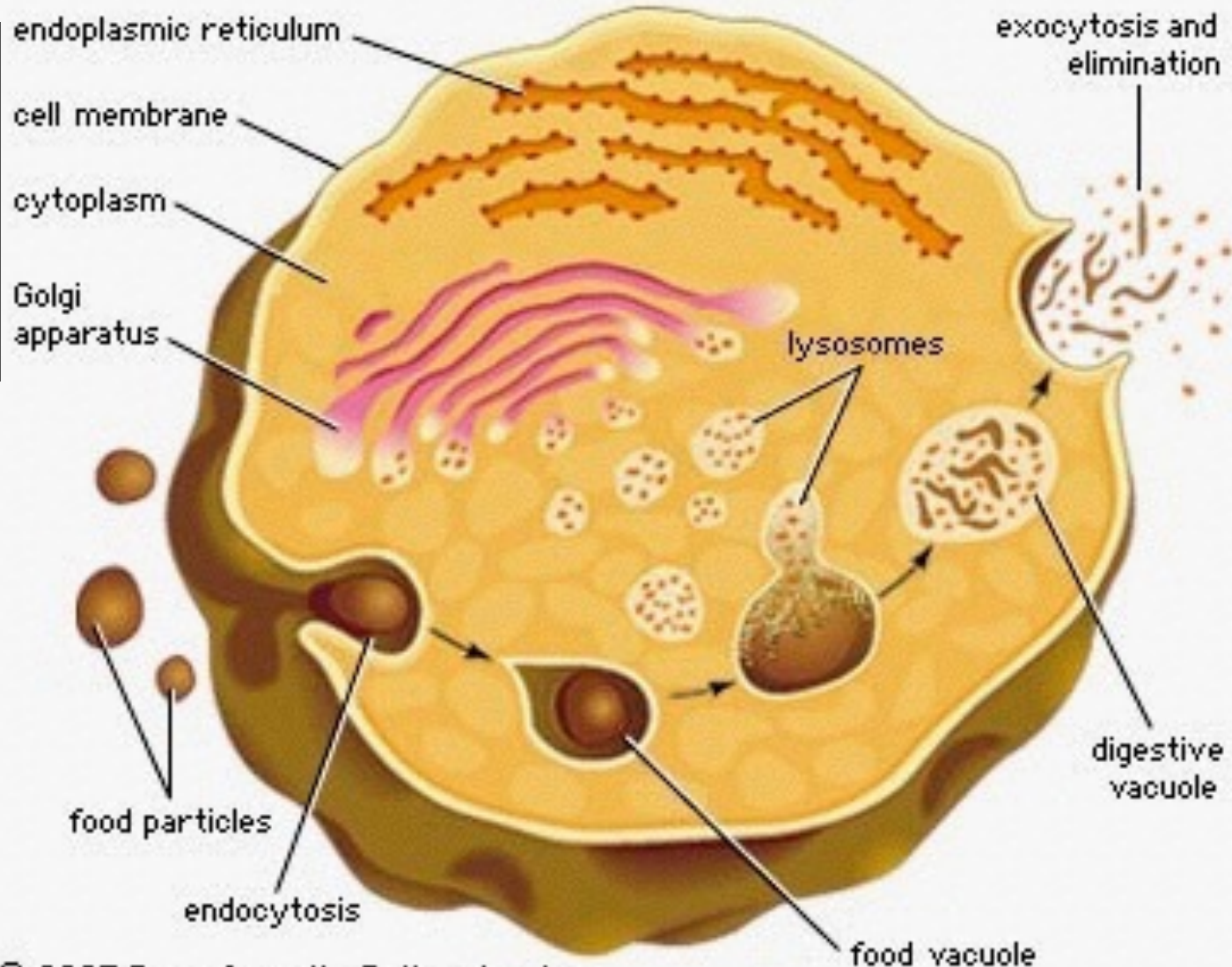


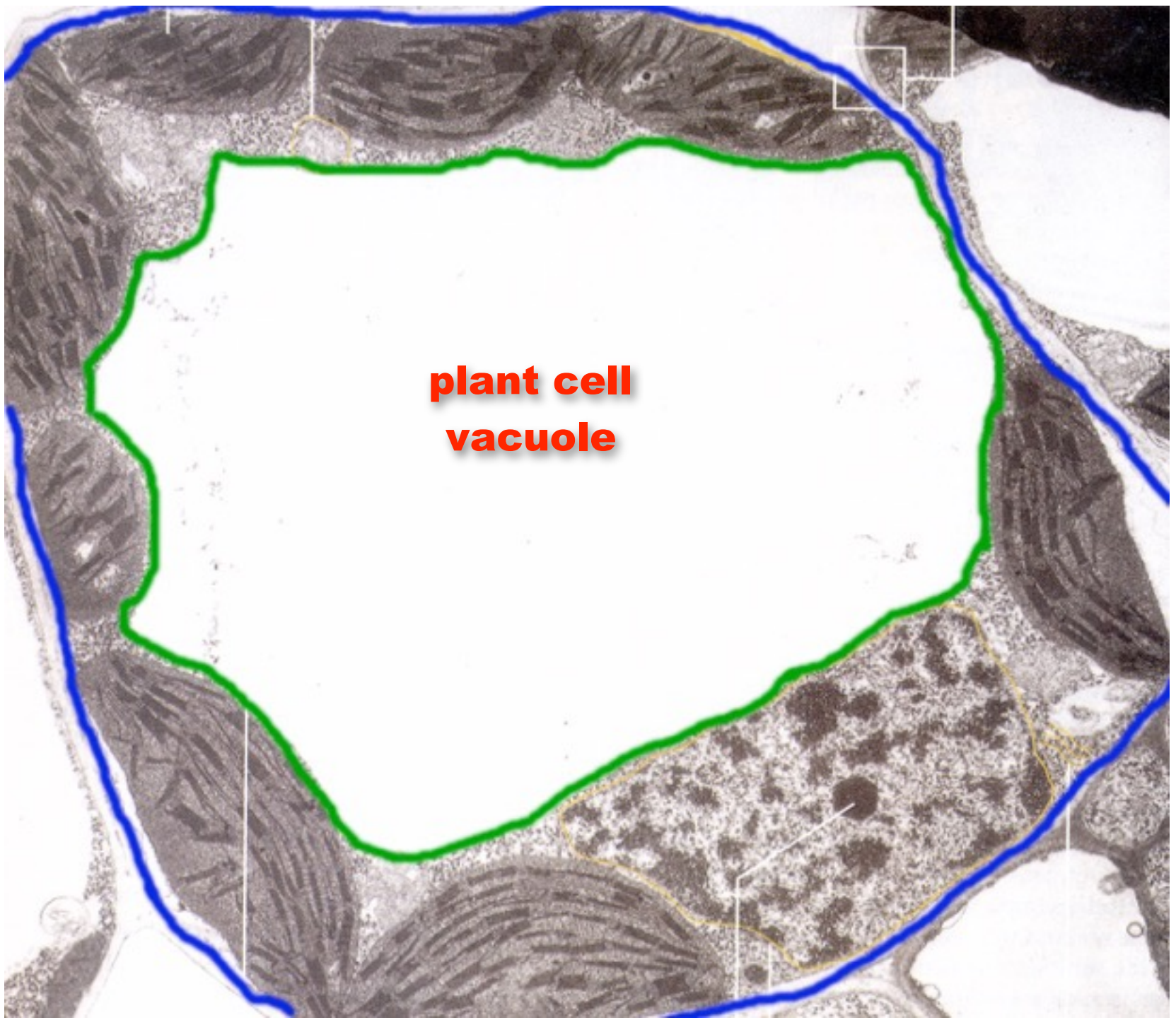
vesicles

20 μ m

VACUOLE

Vacuoles are larger and are formed by phagocytosis (cell eating).

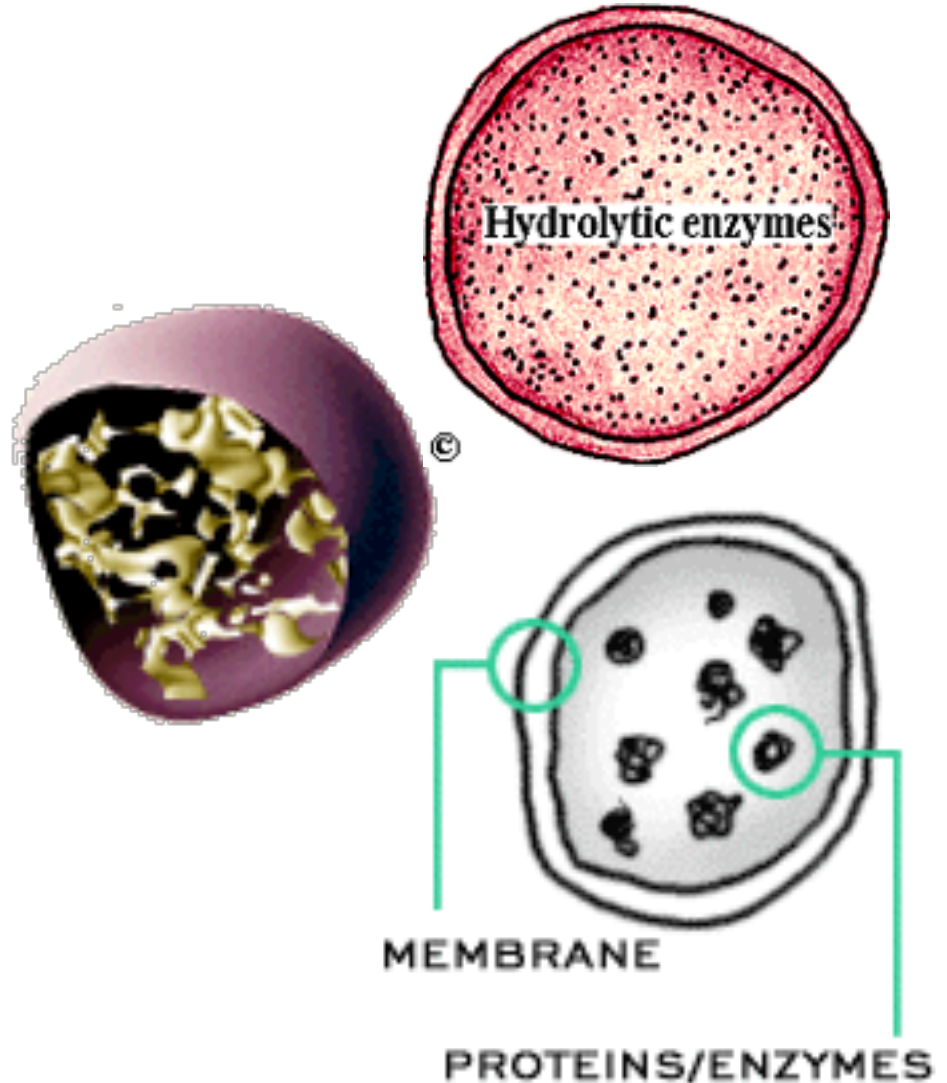
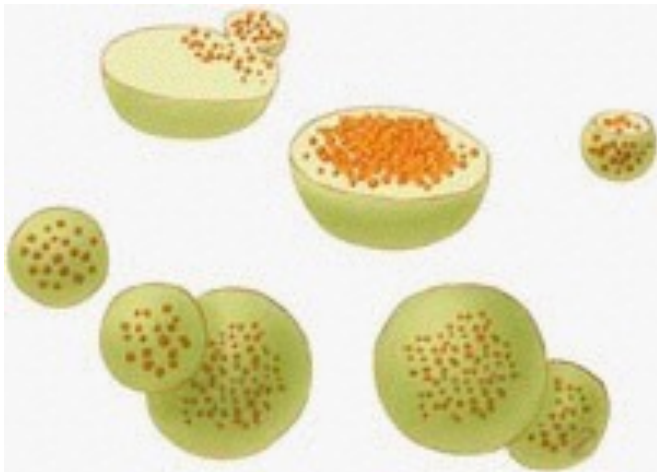




**plant cell
vacuole**

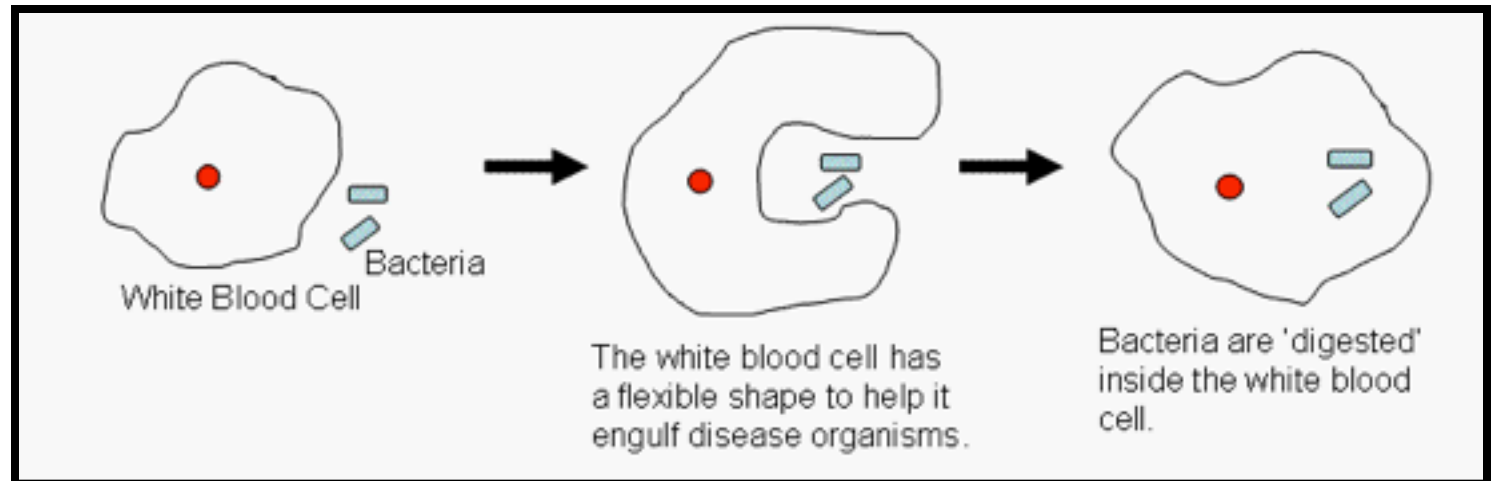
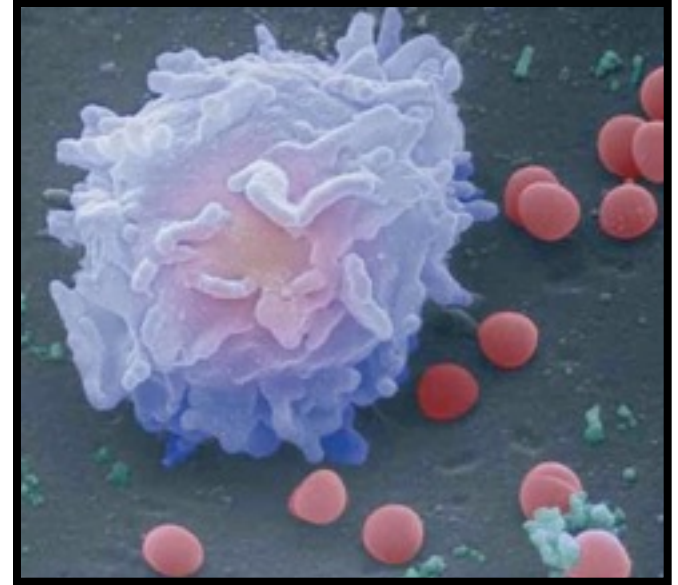
LYSOSOME

1. These are double membraned vacuoles with hydrolytic (digestive) enzymes.
2. Made by the golgi body.
3. They are also known as 'suicide-sacs'.



LYSOSOME -- HYDROLYSIS

1. They attach to food vacuoles and digest their contents.
2. They also destroy old or malfunctioning cell parts.
3. They are capable of destroying bacteria.



Plasma membrane

Rough ER

Transport vesicle

Golgi apparatus

Food

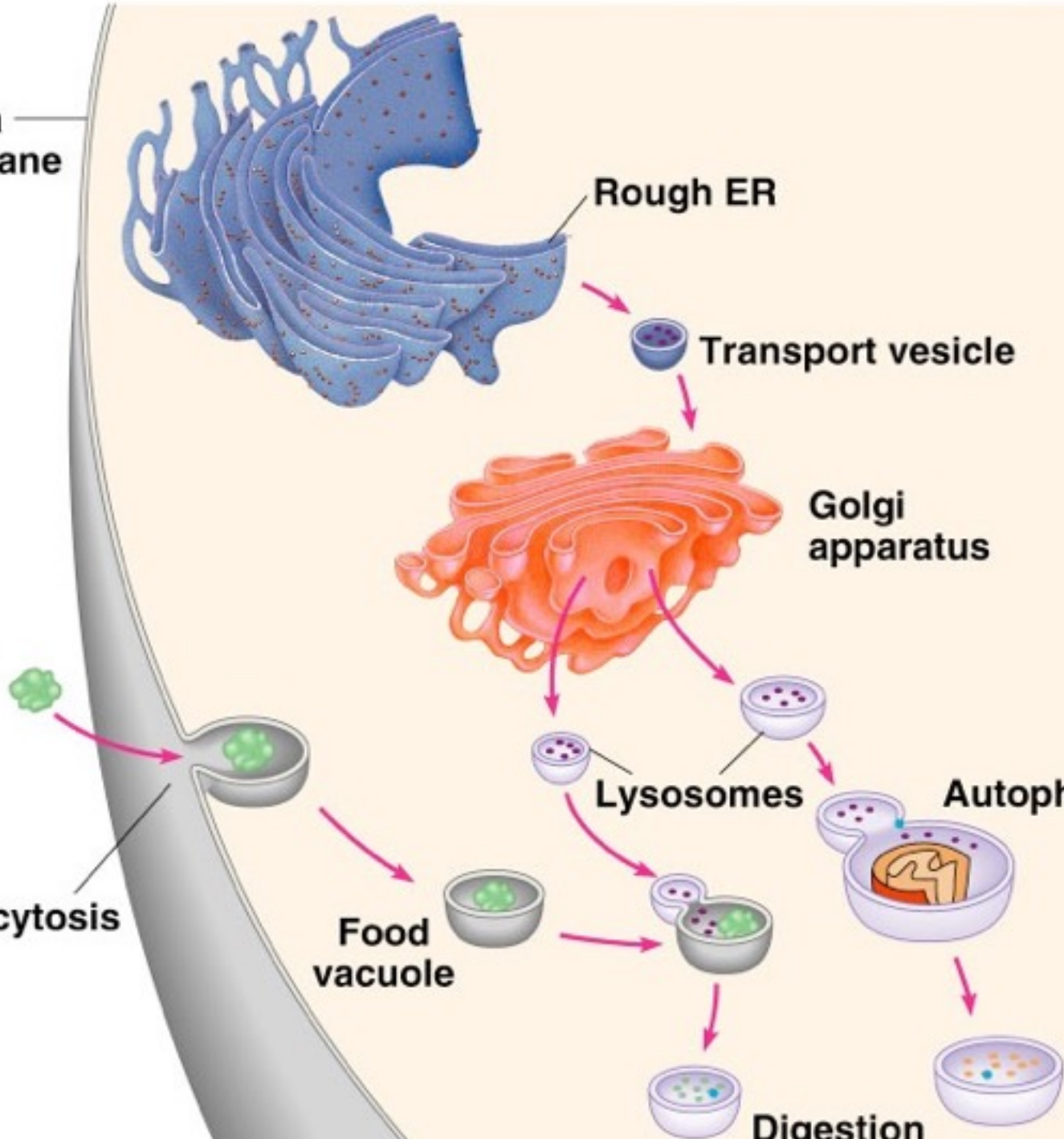
Lysosomes

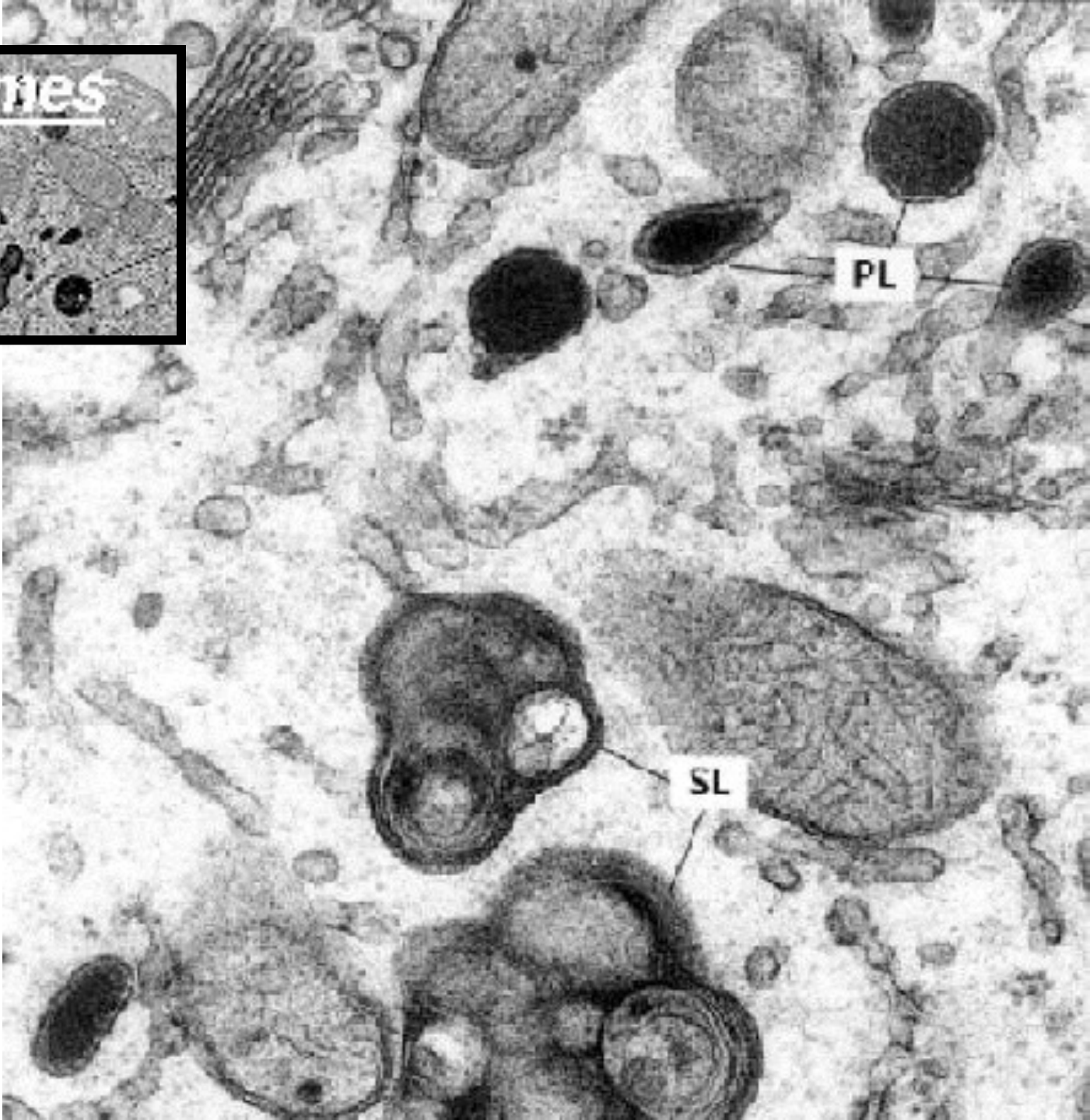
Autophagy

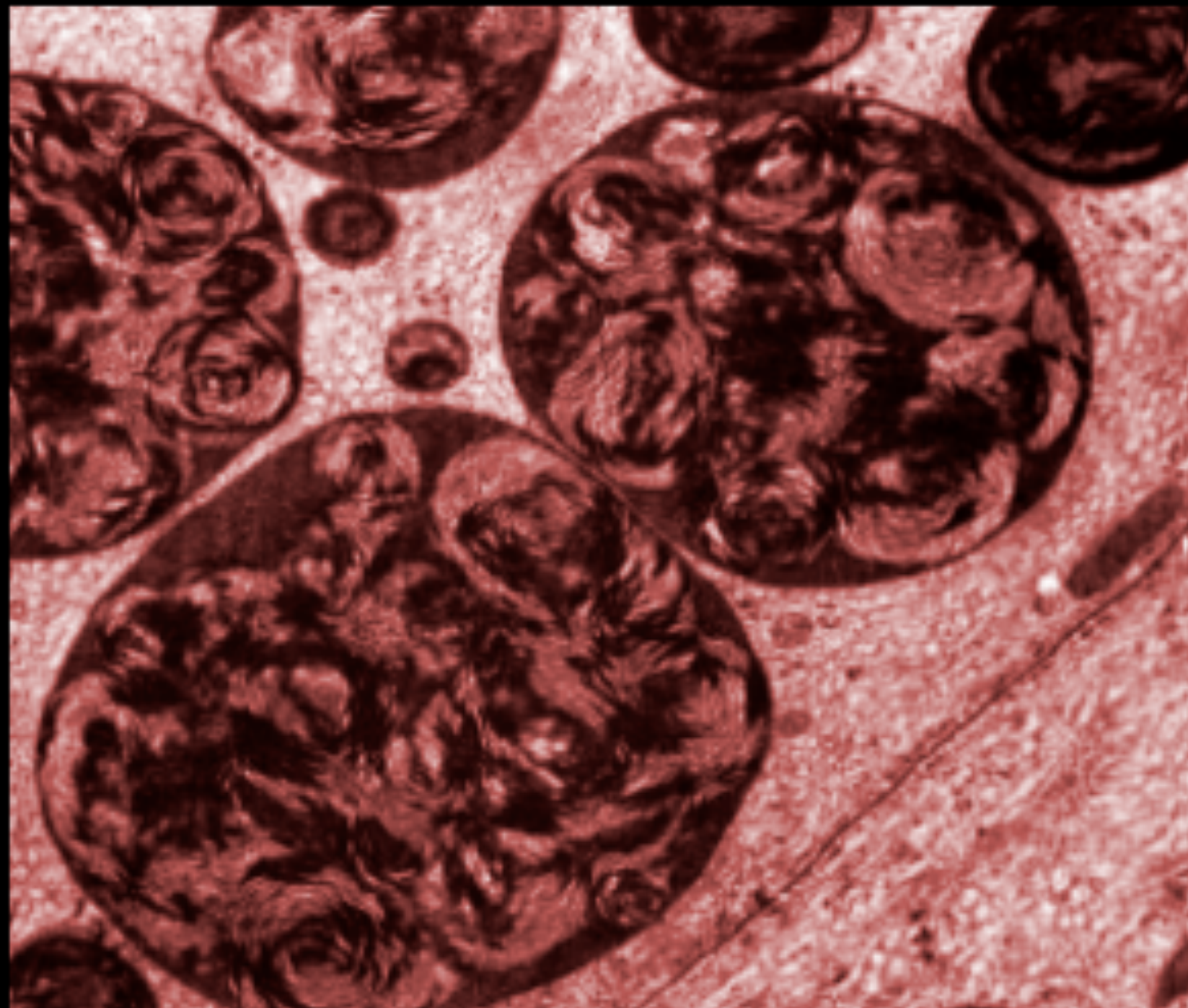
Phagocytosis

Food vacuole

Digestion







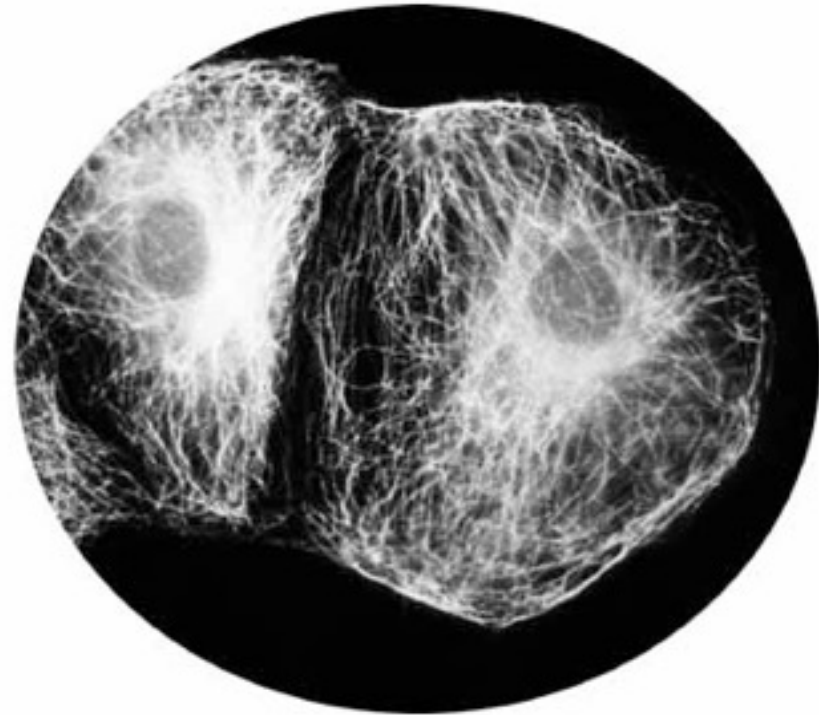
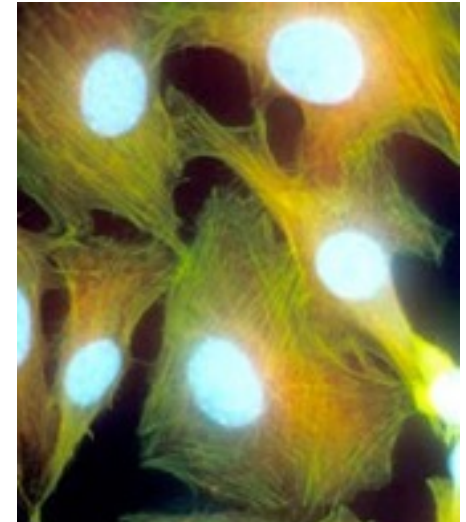
CYTOSKELETON

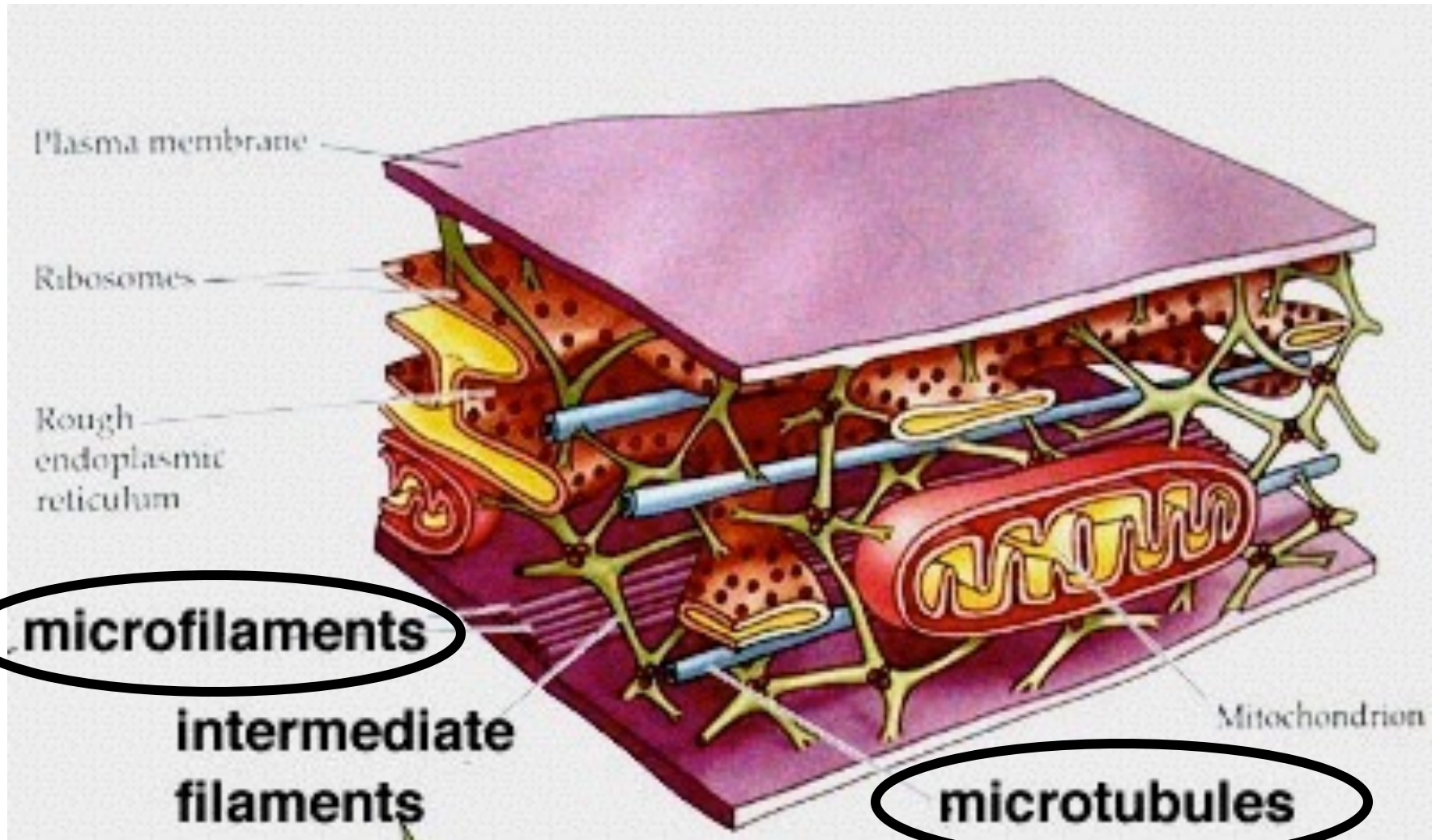
This gives the cell its shape and form. It anchors and supports the cell organelles.

It also serves as a monorail to transport organelles around the cell.

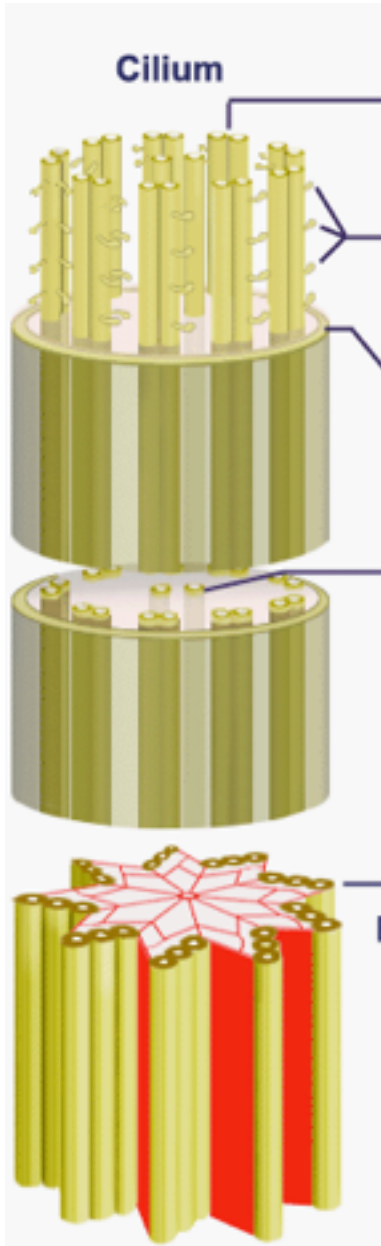
There are two components to the cytoskeleton:

1. Microtubules
2. Microfilaments

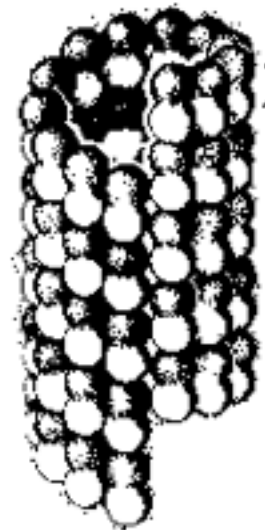




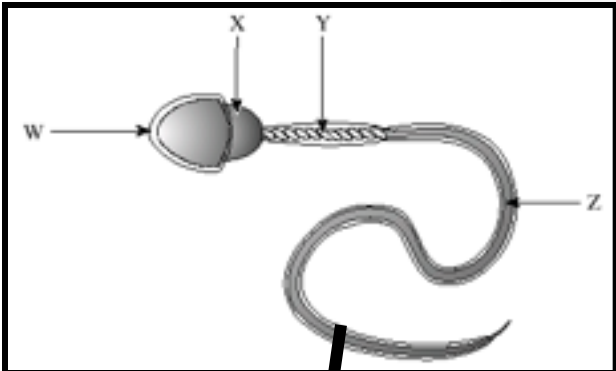
MICROTUBULE



1. These are larger than microfilaments.
2. They are cylinder shaped and made of a coiled protein called tubulin.
3. Along with making up the cytoskeleton, they are used to make cilia, flagella, centrioles and spindle fibres.



ORGANELLES



Flagella

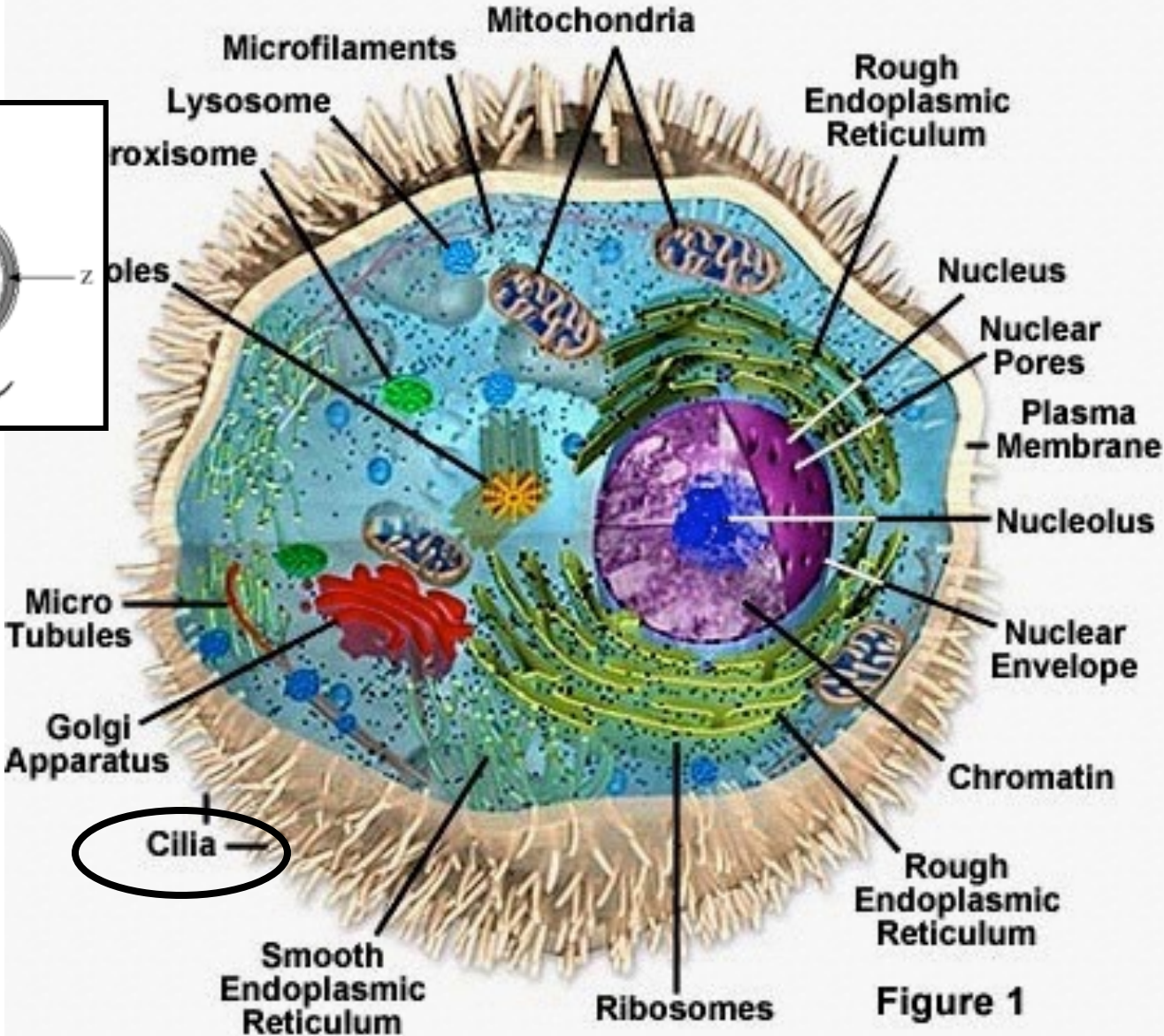
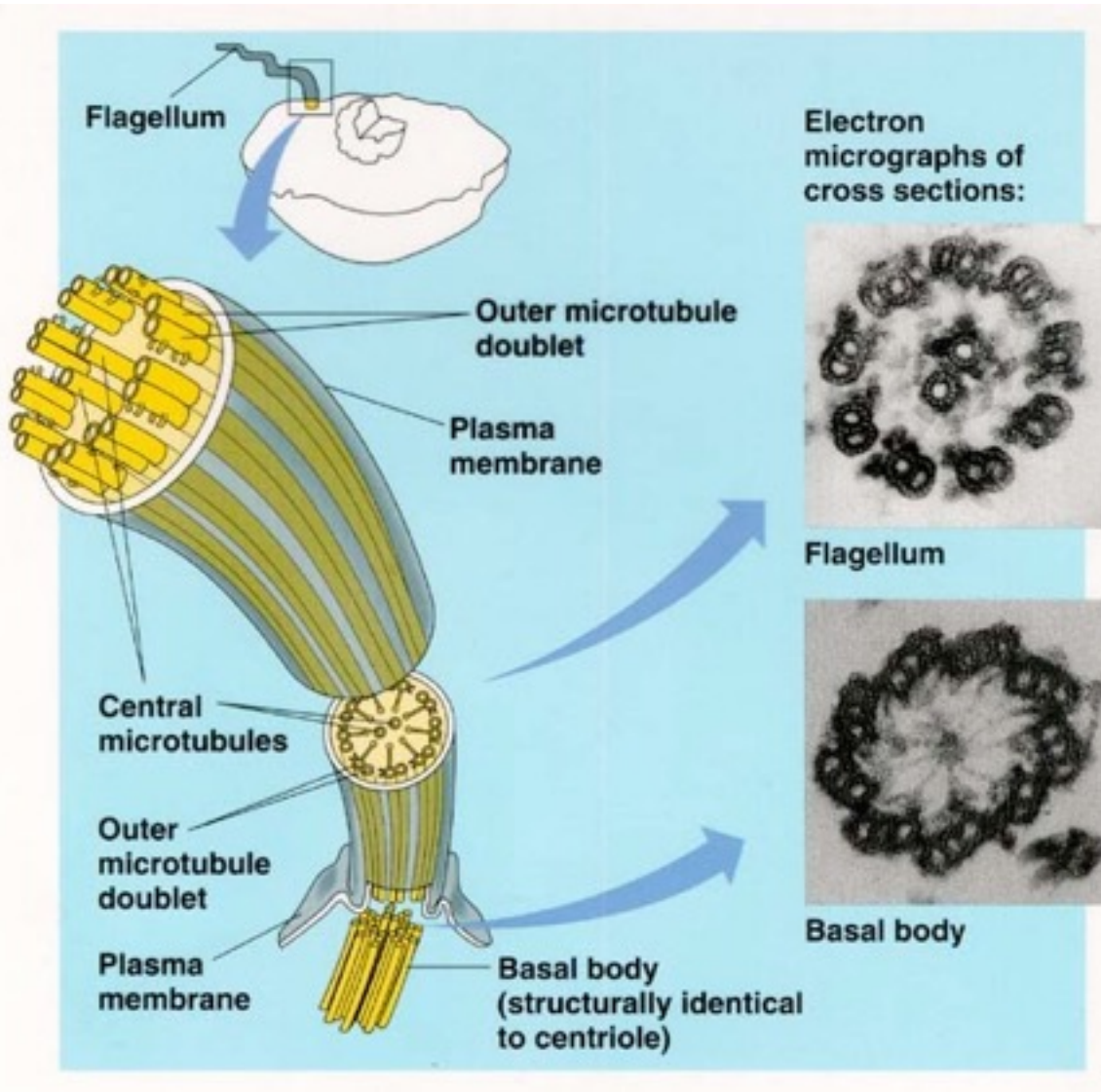
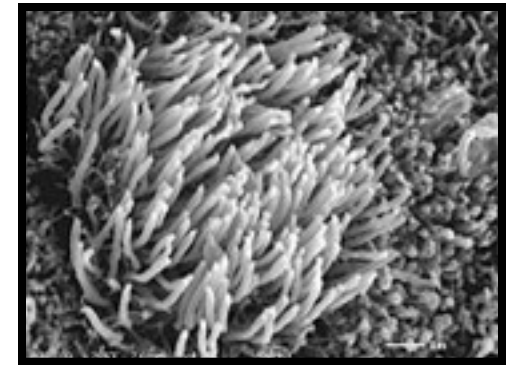


Figure 1

Cilia & Flagella



1. These are hair like projections, which use energy to produce movement/locomotion.
2. They move as the pairs of tubules slide against each other.
3. Cilia are short and there are many of them. Flagella are long and few.

1. They are made of 'microtubules' ('9+2').
2. Anchored to cell by a basal body ('9+0')

Ultrastructure of Cilia and Flagella

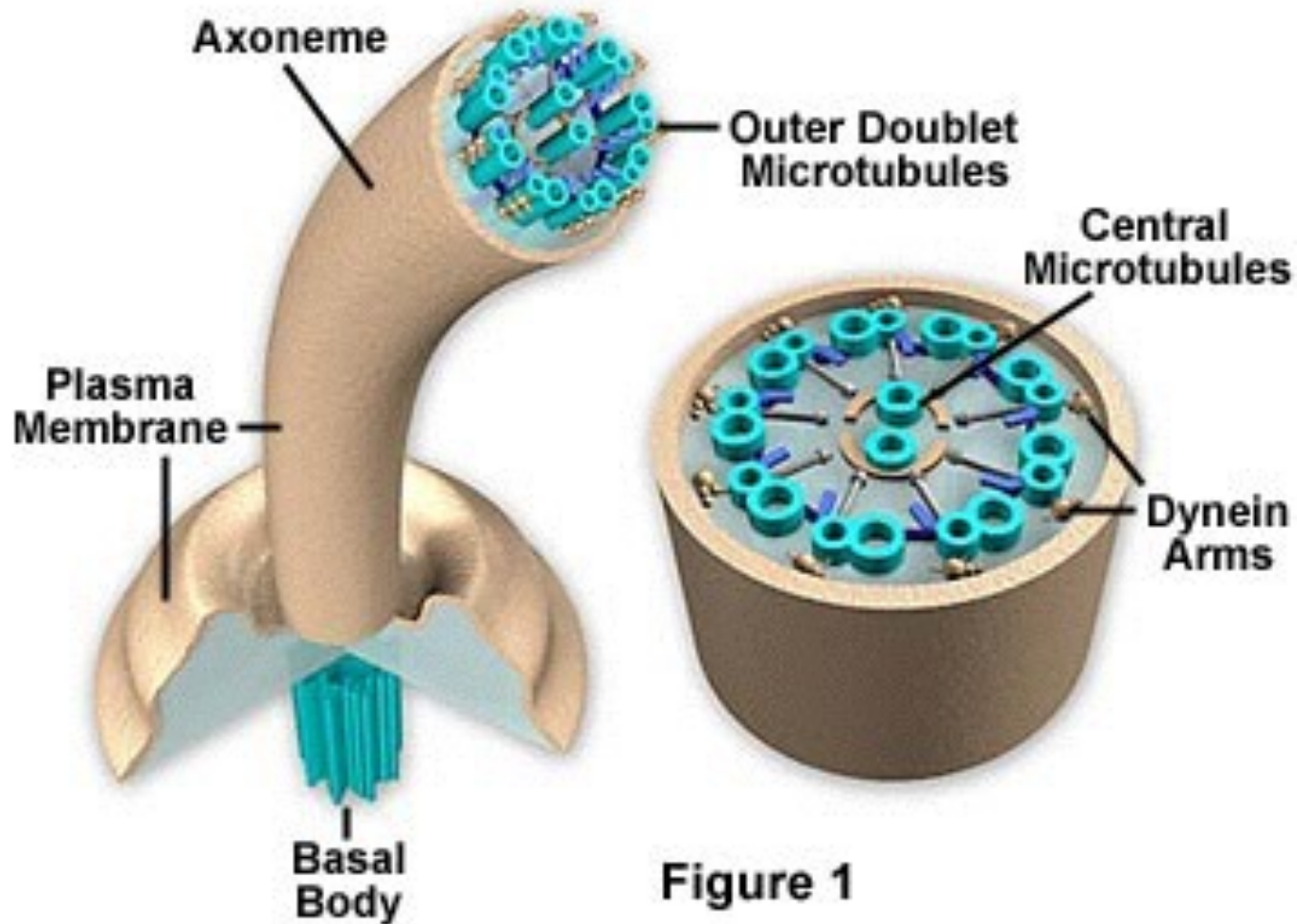
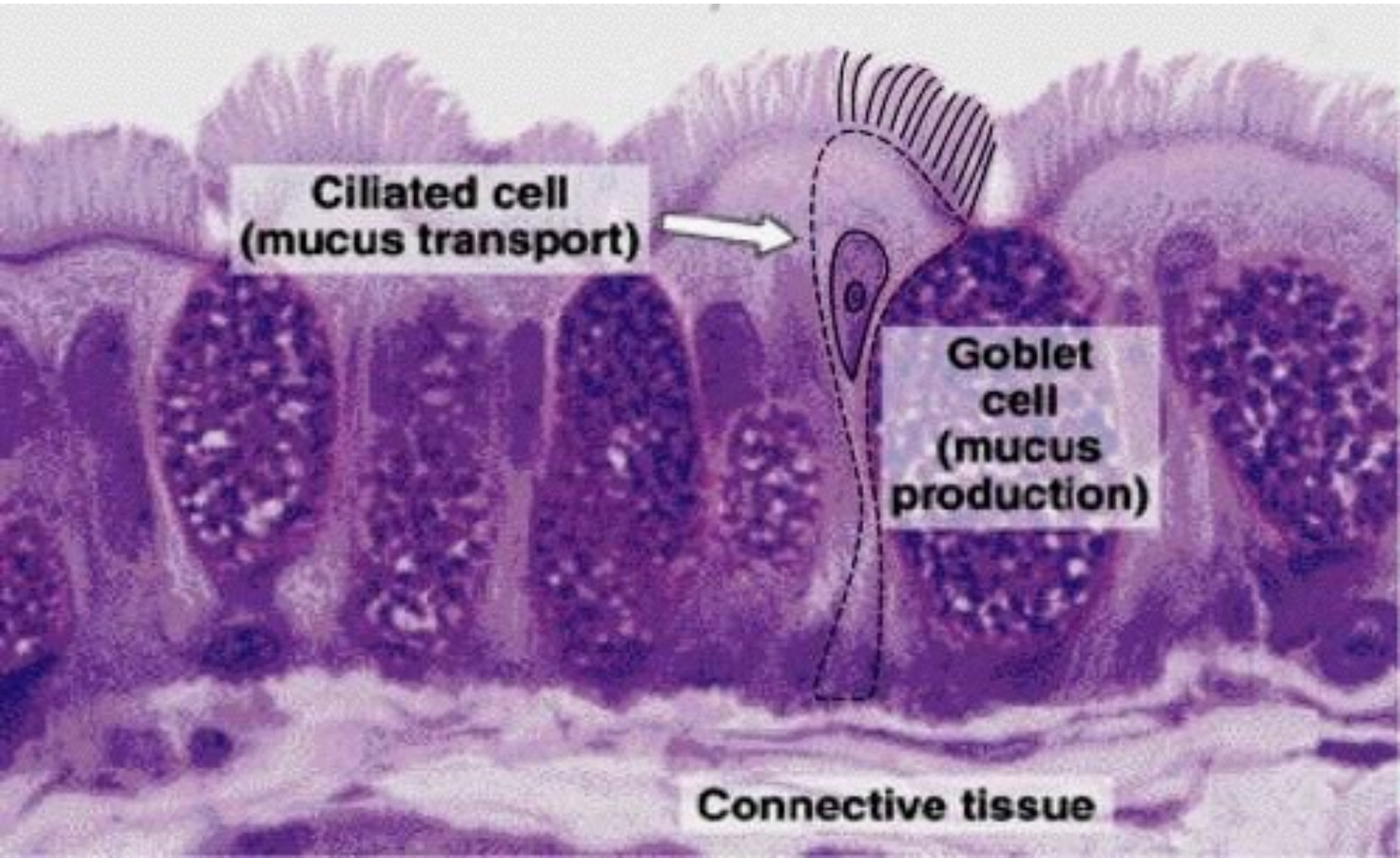
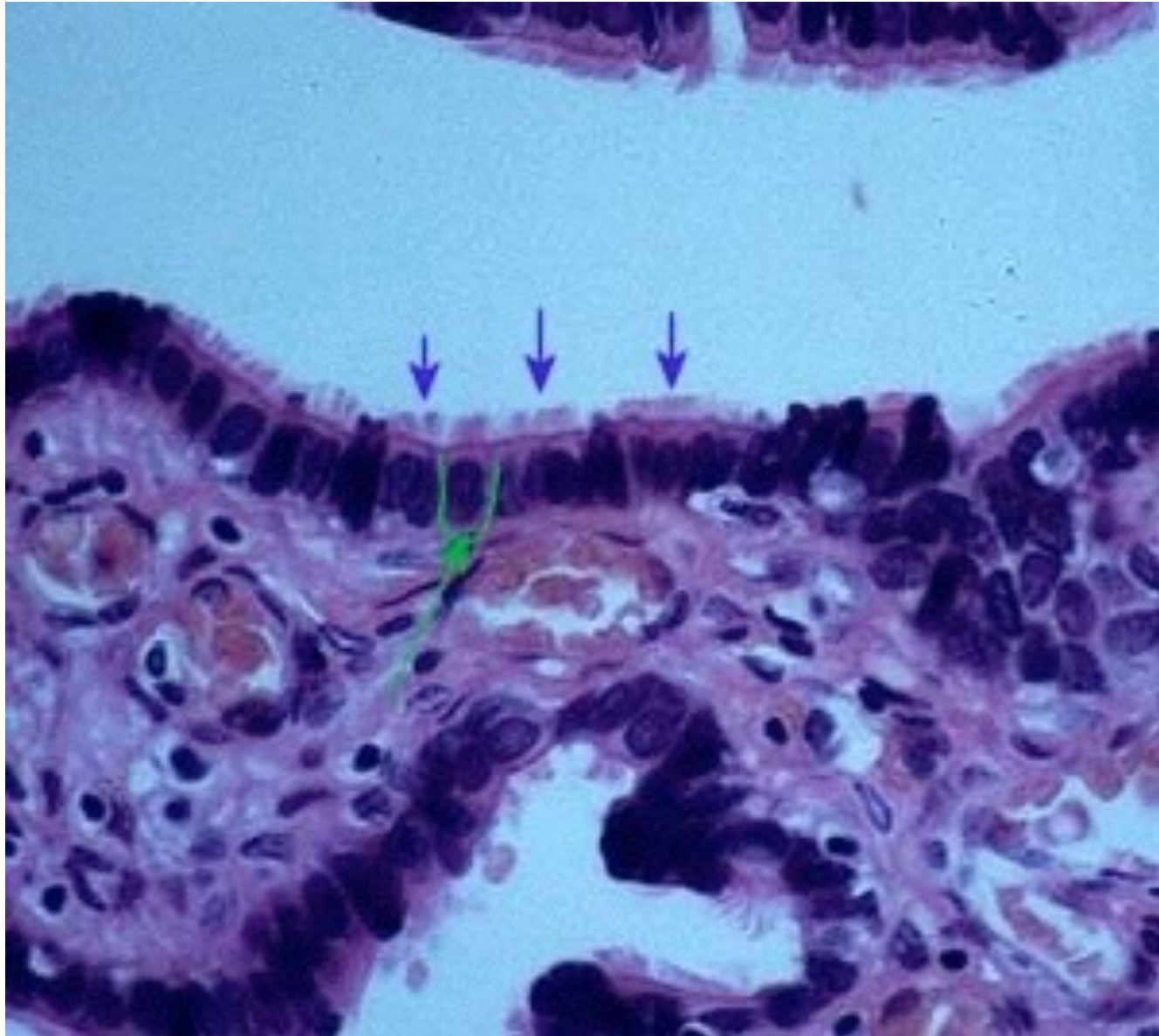


Figure 1

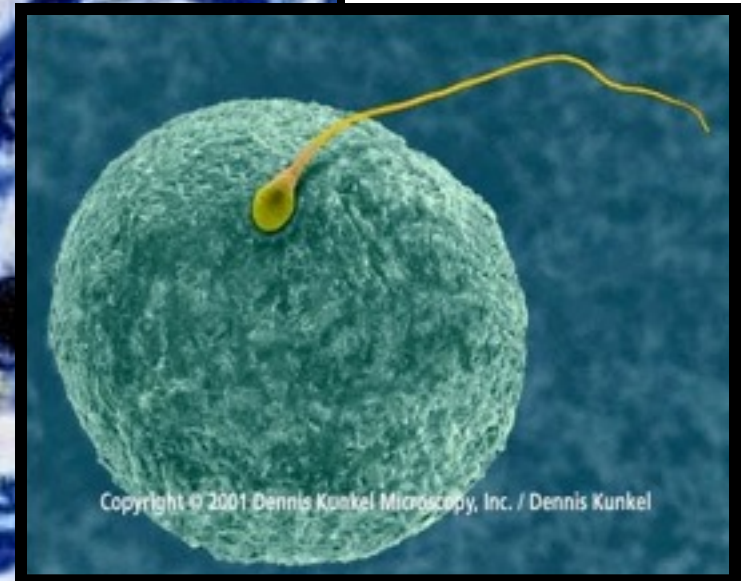
Cilia in trachea



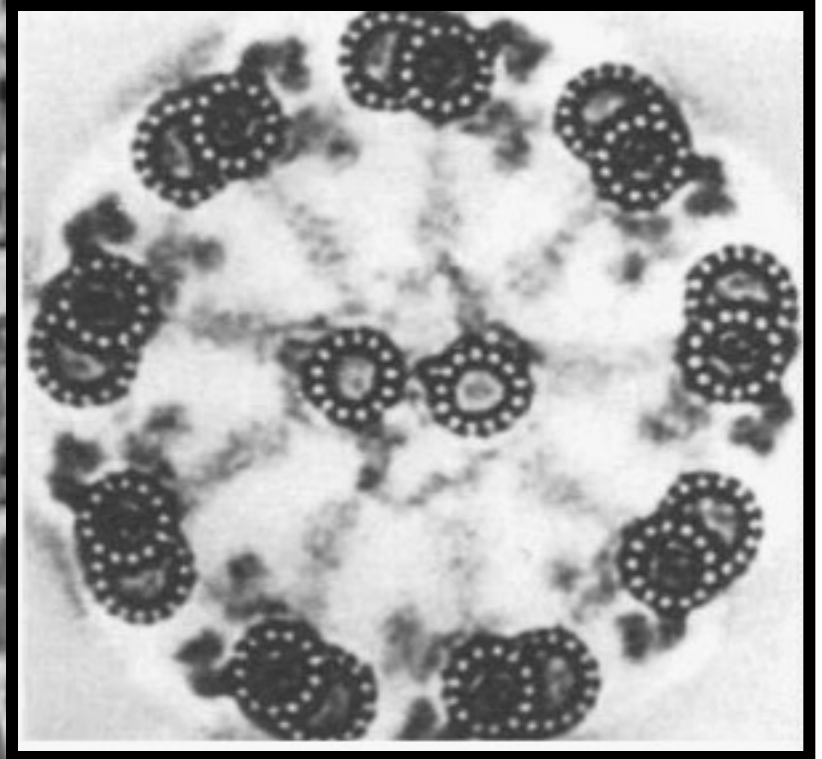
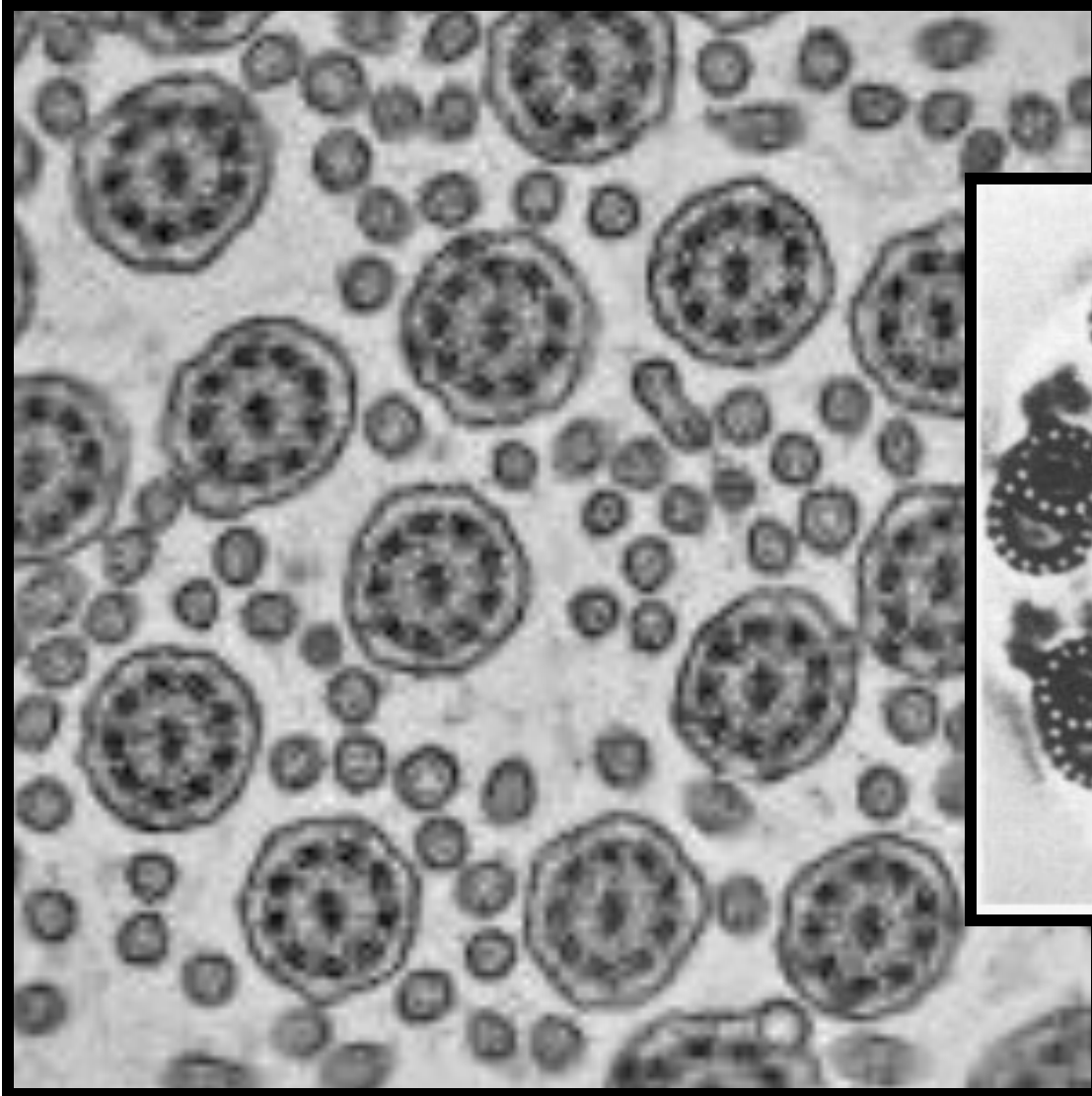
Cilia in oviduct



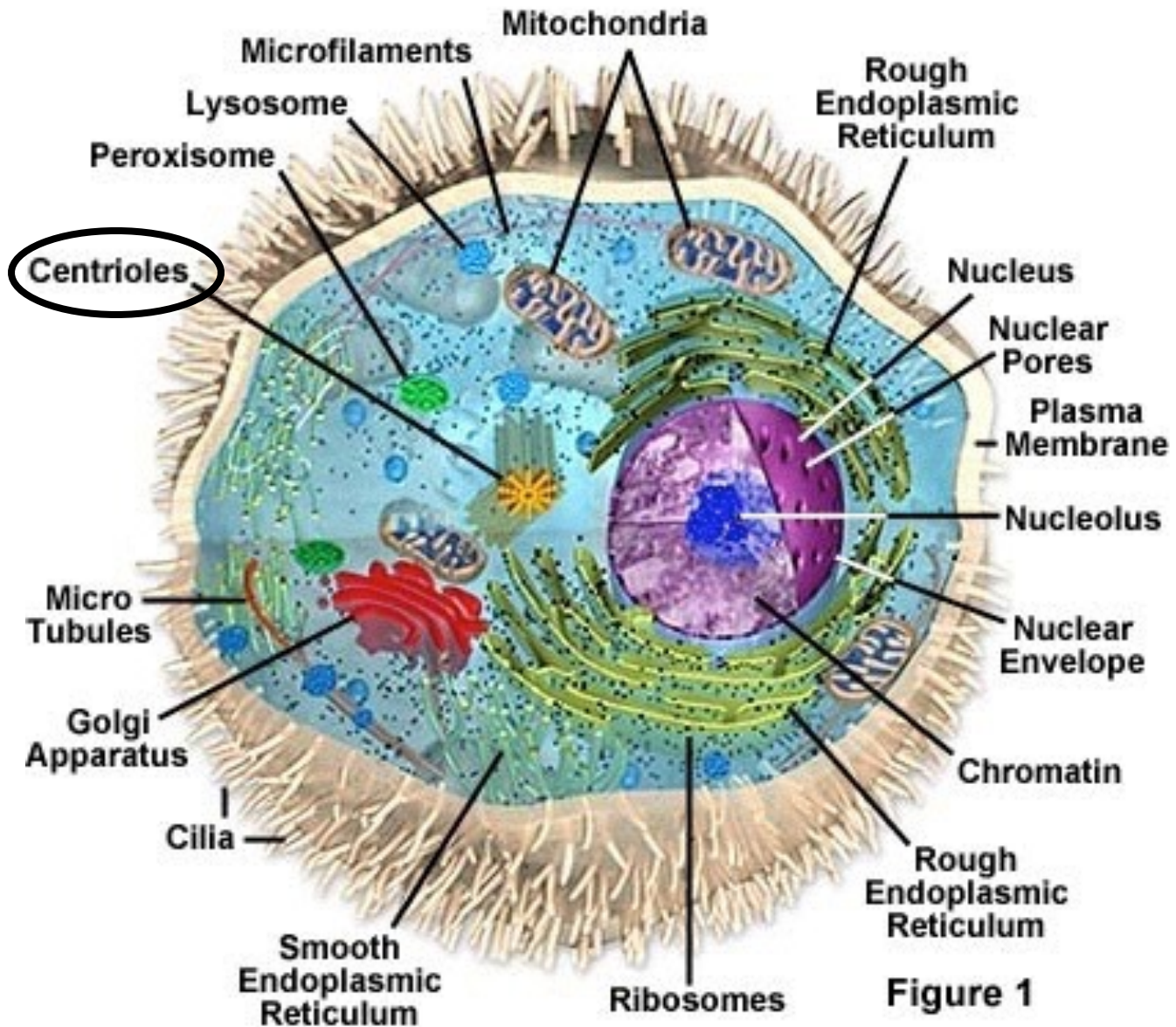
FLAGELLA



Cross section



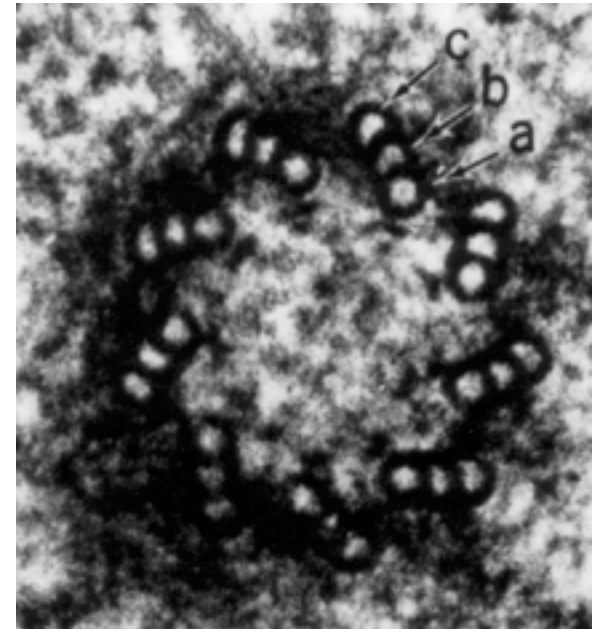
ORGANELLES

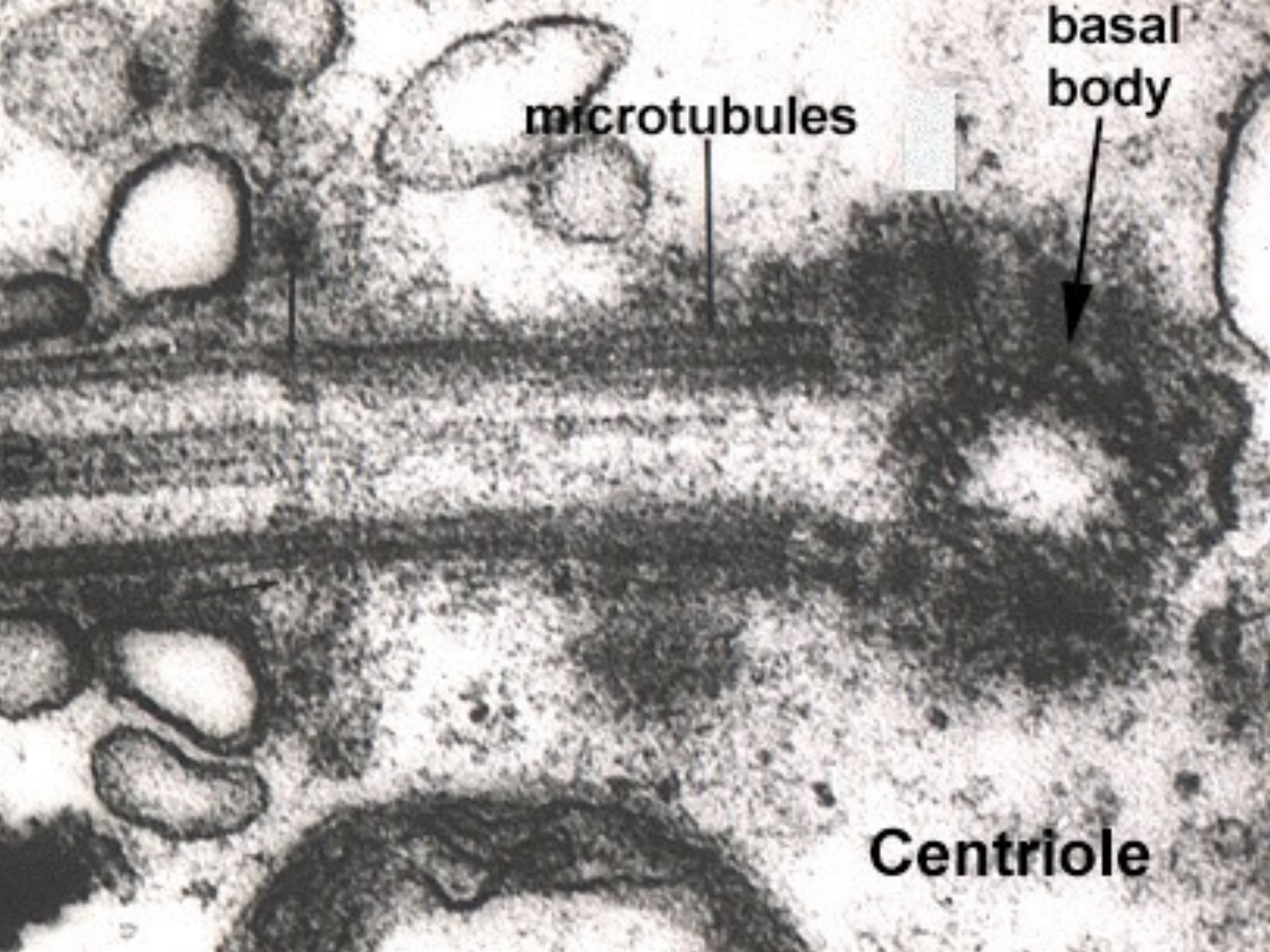


CENTRIOLE



1. A pair of basal bodies (microtubules) that grow spindle fibers
2. They attach to and move chromosomes during mitosis.
3. These are found in animal cells only.





microtubules

basal
body

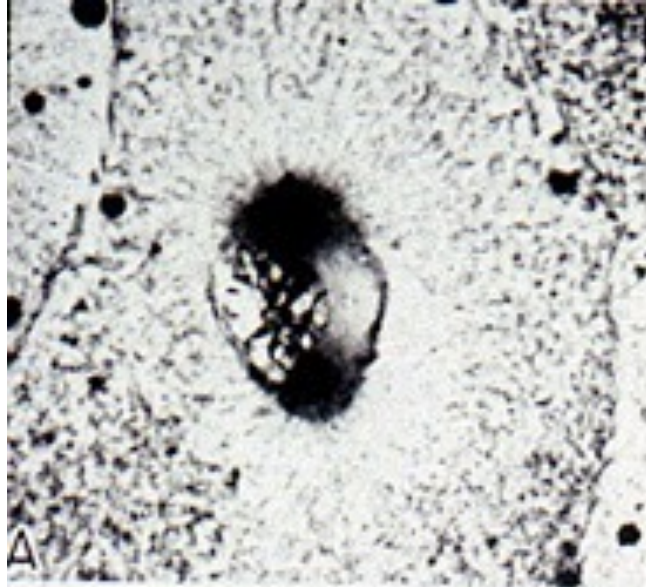
Centriole

Interphase

Centriole

Nucleus

Chromatin



MICROFILAMENTS

1. They are long and extremely thin protein fibres that occur in bundles made of 2 proteins called Actin and Myosin.
2. Organelles move around the cytoplasm on these.

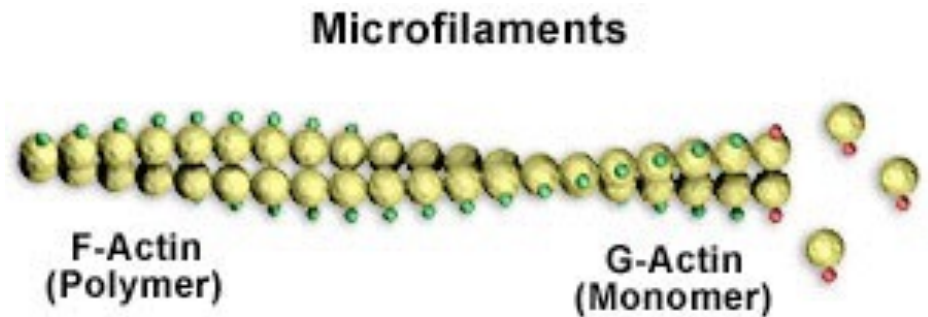
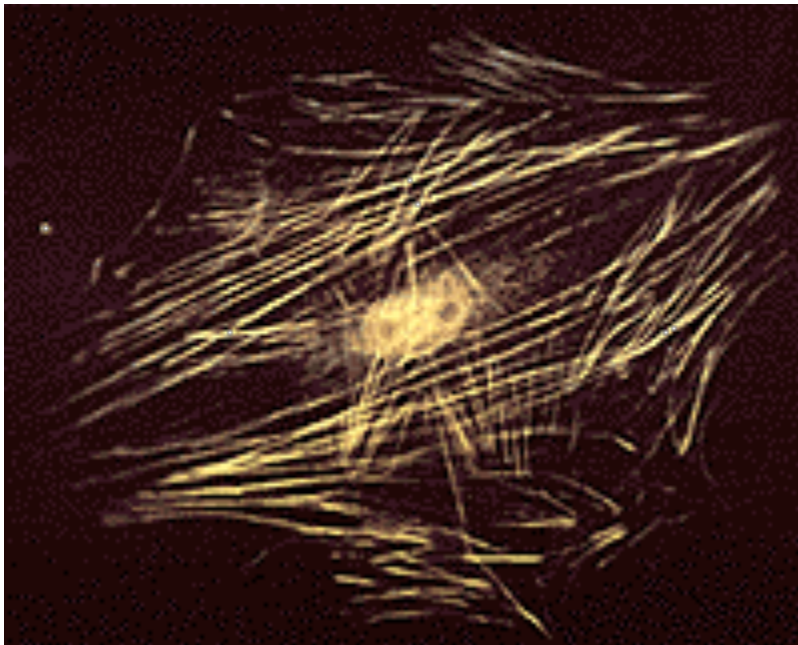
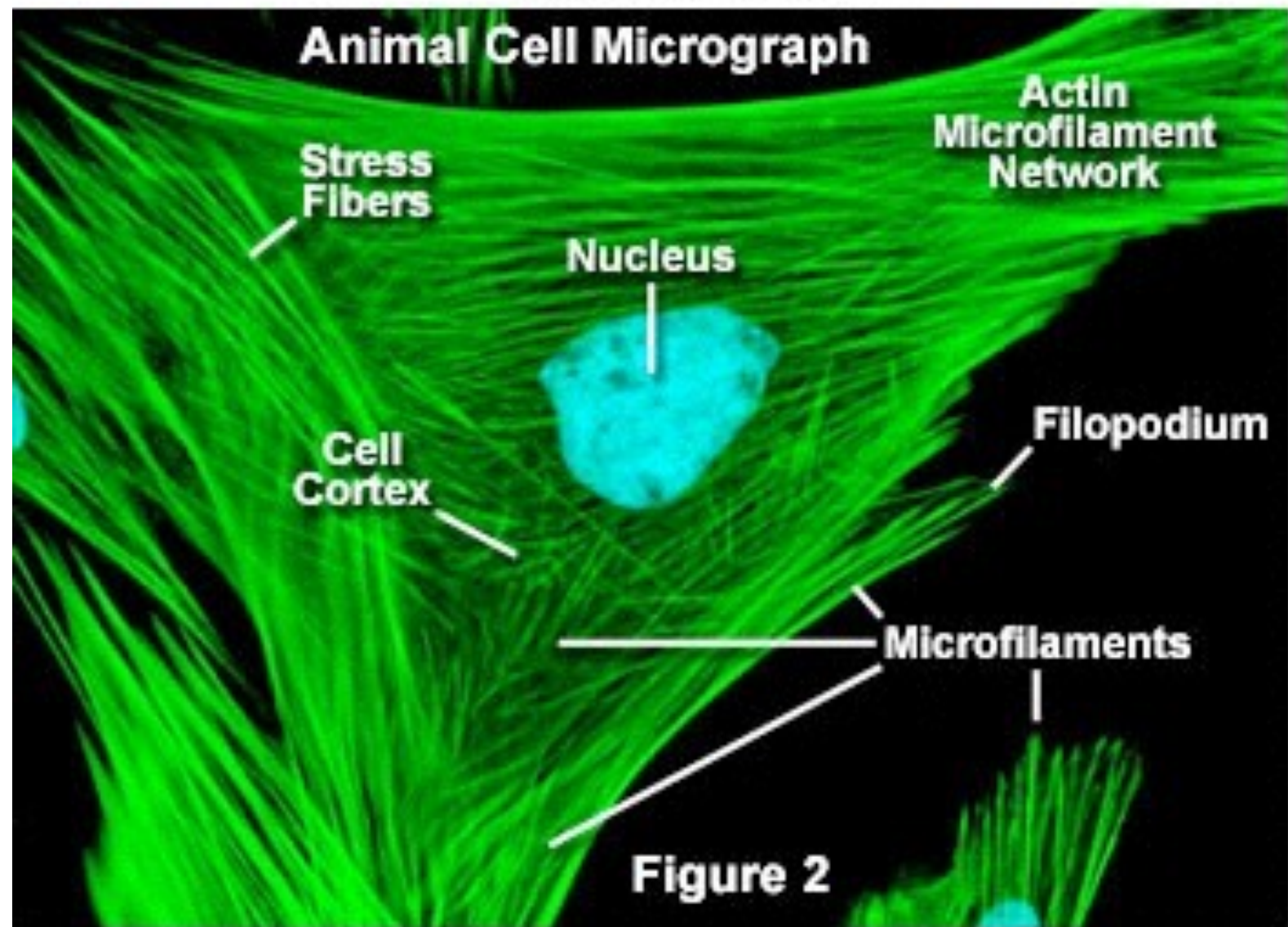
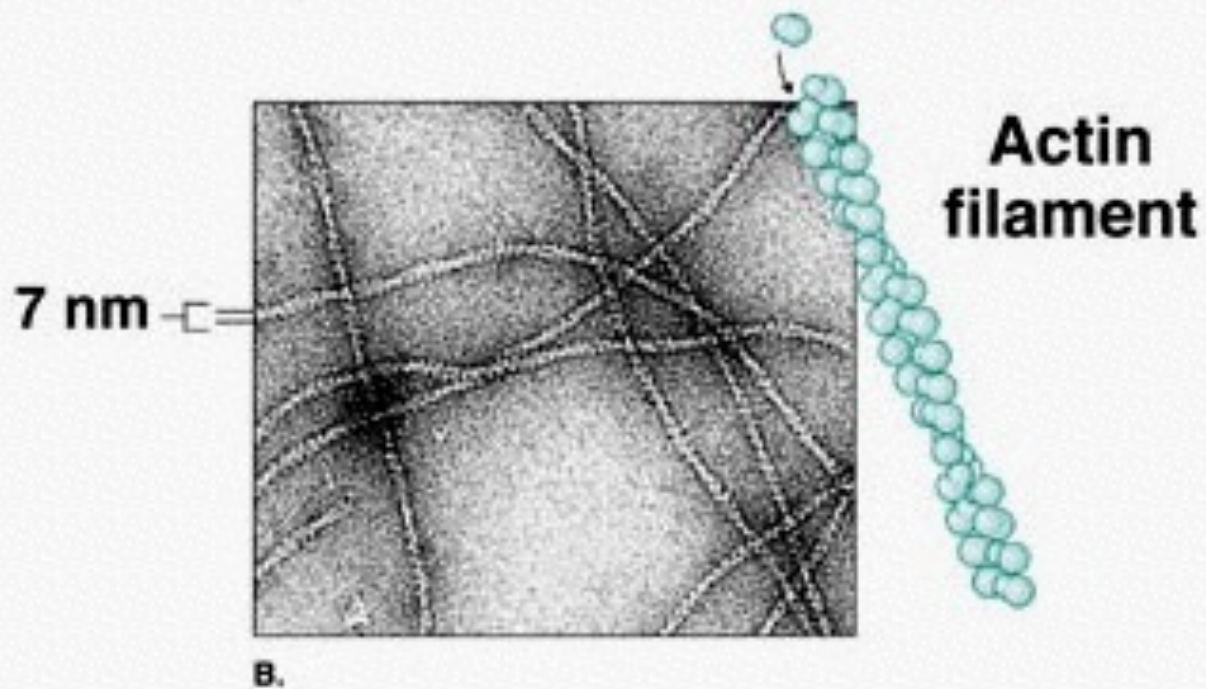
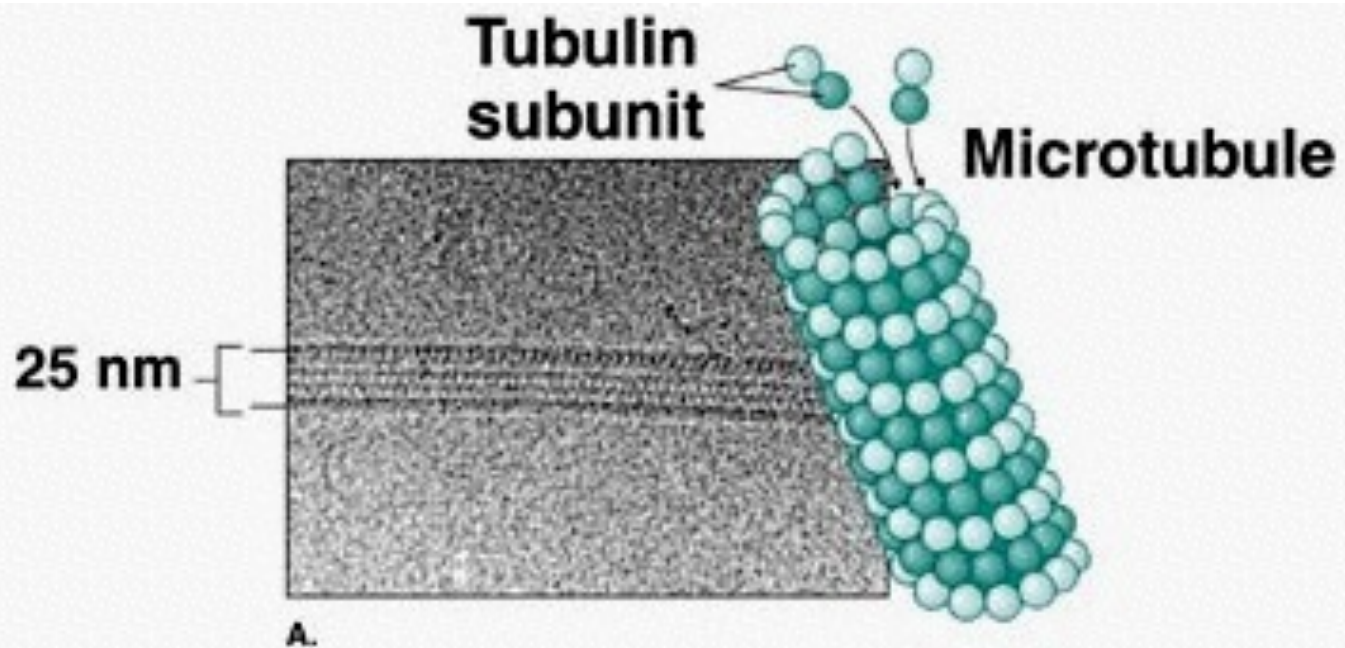


Figure 1

Microfilaments



<http://micro.magnet.fsu.edu>



CYTOPLASM

1. This is a 'watery gel' that contains mainly water with dissolved salts, proteins and other organic compounds.
2. It's functions are to support and suspend organelles and to provide water for all of the cells biochemistry.

