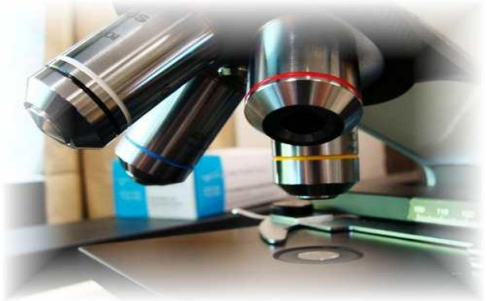

About Science Prof Online PowerPoint Resources

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- The SPO Virtual Classrooms offer many educational resources, including practice test questions, review questions, lecture PowerPoints, video tutorials, sample assignments and course syllabi. New materials are continually being developed, so check back frequently, or follow us on Facebook (Science Prof Online) or Twitter (ScienceProfSPO) for updates.

- Many SPO PowerPoints are available in a variety of formats, such as fully editable PowerPoint files, as well as uneditable versions in smaller file sizes, such as PowerPoint Shows and Portable Document Format (.pdf), for ease of printing.

- Images used on this resource, and on the SPO website are, wherever possible, credited and linked to their source. Any words underlined and appearing in blue are links that can be clicked on for more information. PowerPoints must be viewed in *slide show mode* to use the hyperlinks directly.

- Several helpful links to fun and interactive learning tools are included throughout the PPT and on the Smart Links slide, near the end of each presentation. You must be in *slide show mode* to utilize hyperlinks and animations.

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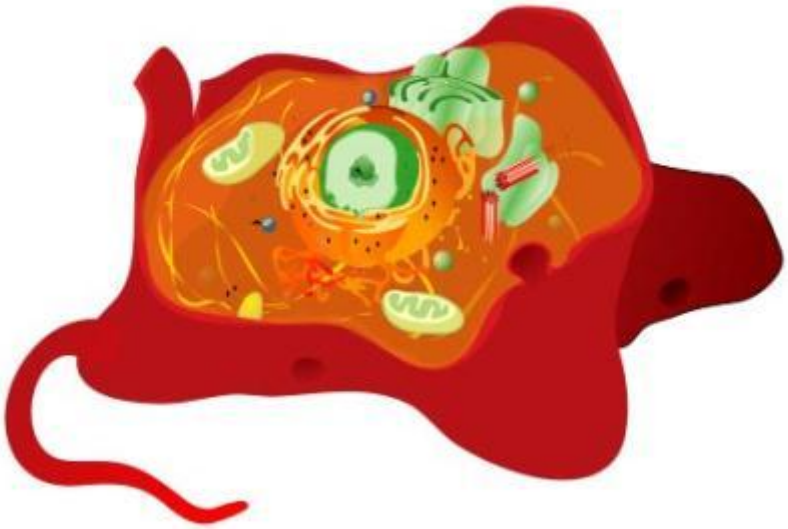
Image: Compound microscope objectives, T. Port

Eukaryotic Cell Structure & Function



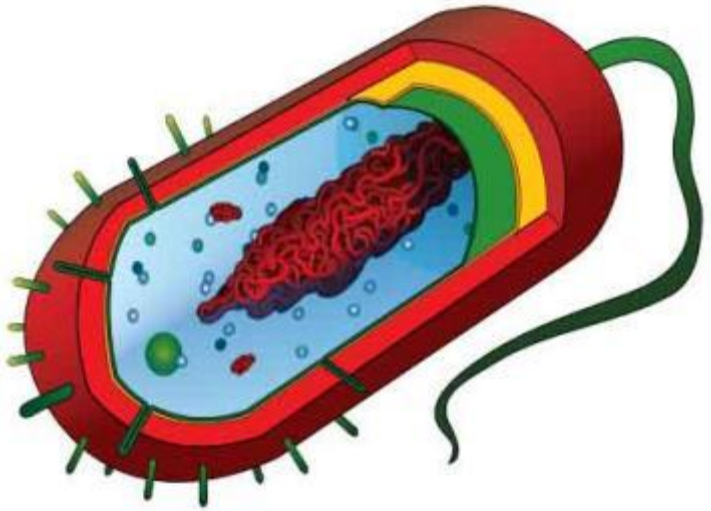
Images: Animal cell & Plant cell, M. Ruiz

From the Virtual Cell Biology Classroom on ScienceProfOnline.com

Q: What are the two basic types of cells?

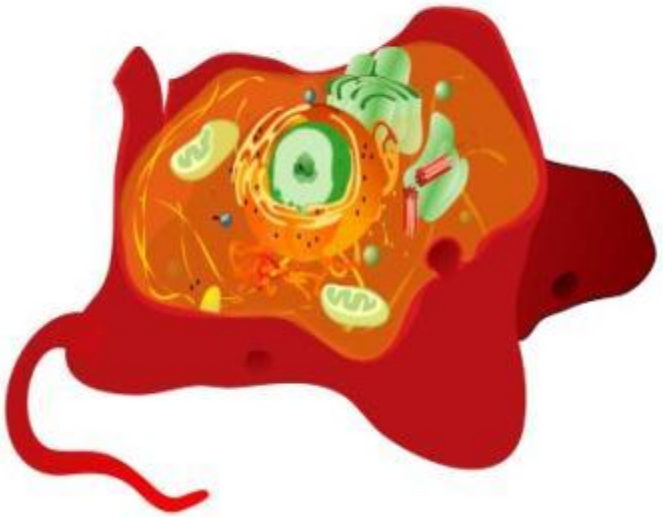
_____

- Single-celled.
- Reproduce by binary fission (another copy by dividing).
- No cell nucleus or any other membrane-bound organelles. DNA travels openly around the cell.
- All bacteria are prokaryotes.



_____

- Eu = "true"; karyon = "nucleus"
- Most organisms that we can see, such as trees, grass, worms, flies, mice, humans, mushrooms and yeast are eukaryotes.
- Can either be single-celled or multi-celled.
- Can reproduce in one of several ways (Ex. meiosis, mitosis).
- Have cell nucleus within containing its DNA.
- Nucleus most evident distinction between these cell types.



Images: Prokaryotic Cell, Eukaryotic cell , M. Ruiz

From the Virtual Cell Biology Classroom on ScienceProfOnline.com

Phylogenetic Tree of Life

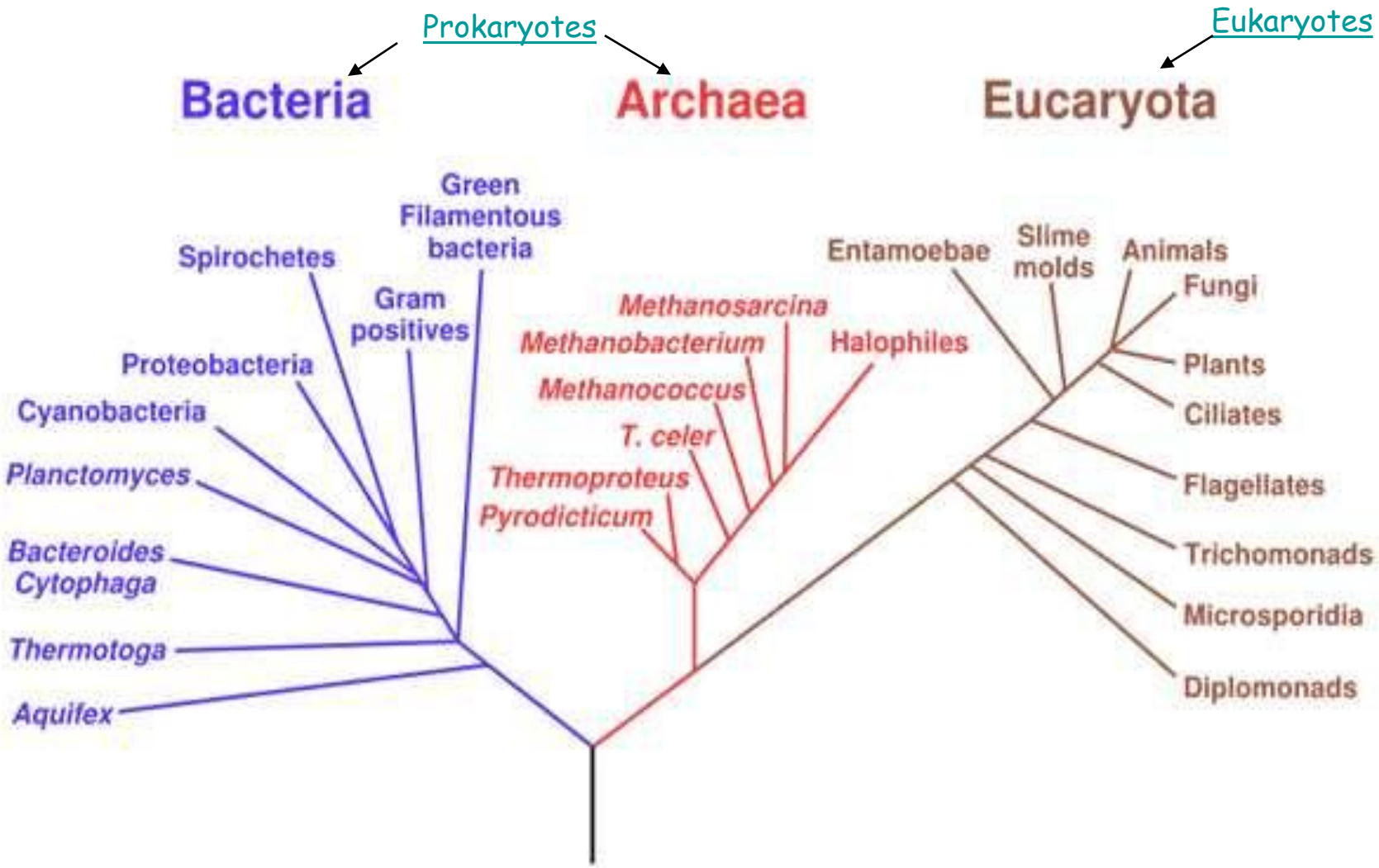


Image: Phylogenetic Tree, Eric Gaba, NASA Astrobiology Institute.

Eukaryotic _____

- Like prokaryotes, and all living things, genome is made of DNA.
- May include several to many linear chromosomes within a membrane-bound nucleus.
- ***Q:*** *How many chromosomes do we have?*
- Replication (duplication of DNA prior to cell division) occurs in all living things.
- Two locations of eukaryotic DNA
  - Nuclear DNA
  - Extranuclear DNA

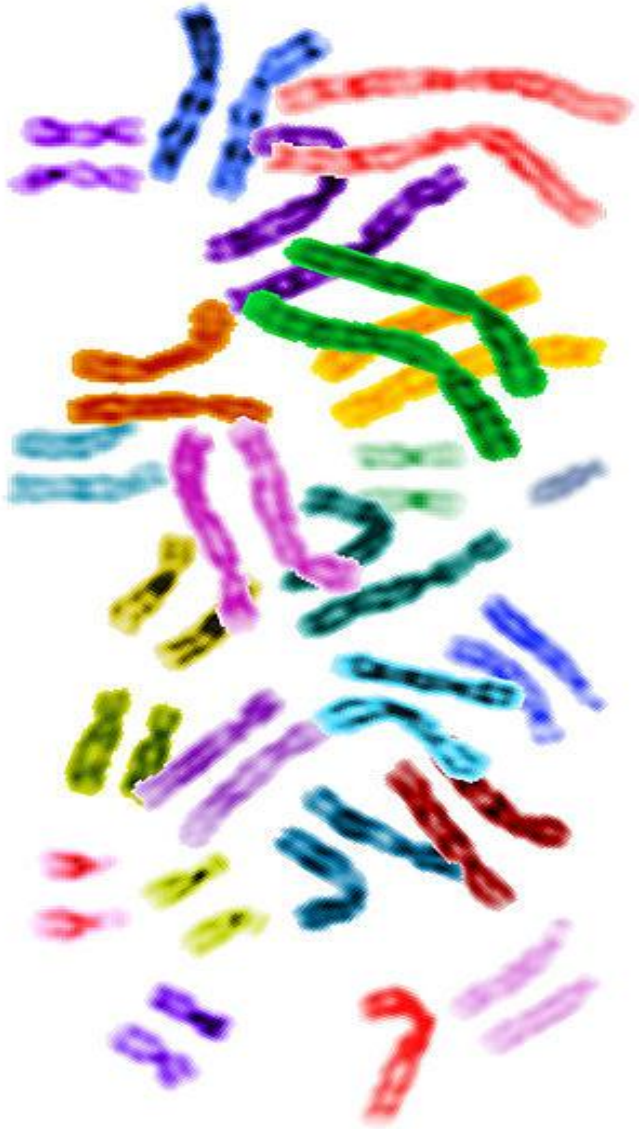


Image: Spectral karyotype, Jane Ades, NHGRI

CYTOPLASM

Nickname: The Matrix

Function: "molecular chowder" in which the organelles are suspended.

- Inside the plasma membrane, the nucleus is surrounded by cytoplasm.
- A water-like substance that fills cells.
- Consists of _____ and _____ _____, except for the cell nucleus.
- **Cytosol** is made up of water, salts, organic molecules and many enzymes that catalyze reactions.

Q: Eukaryotes? Prokaryotes? Both?

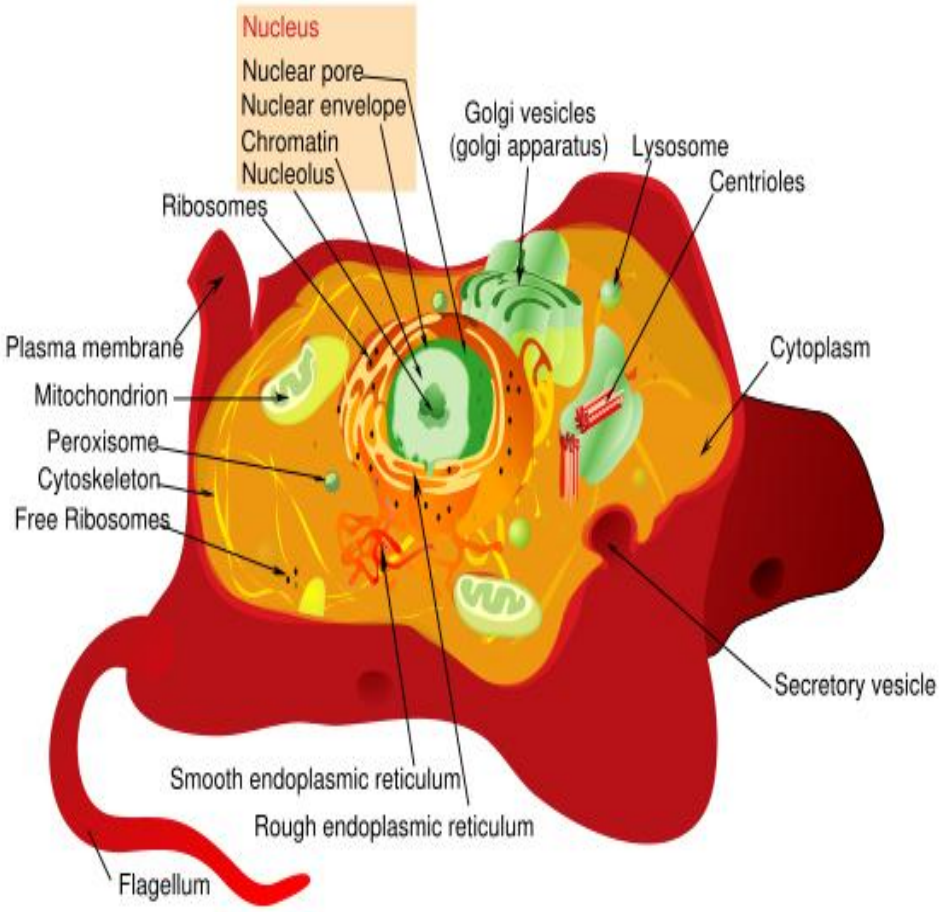


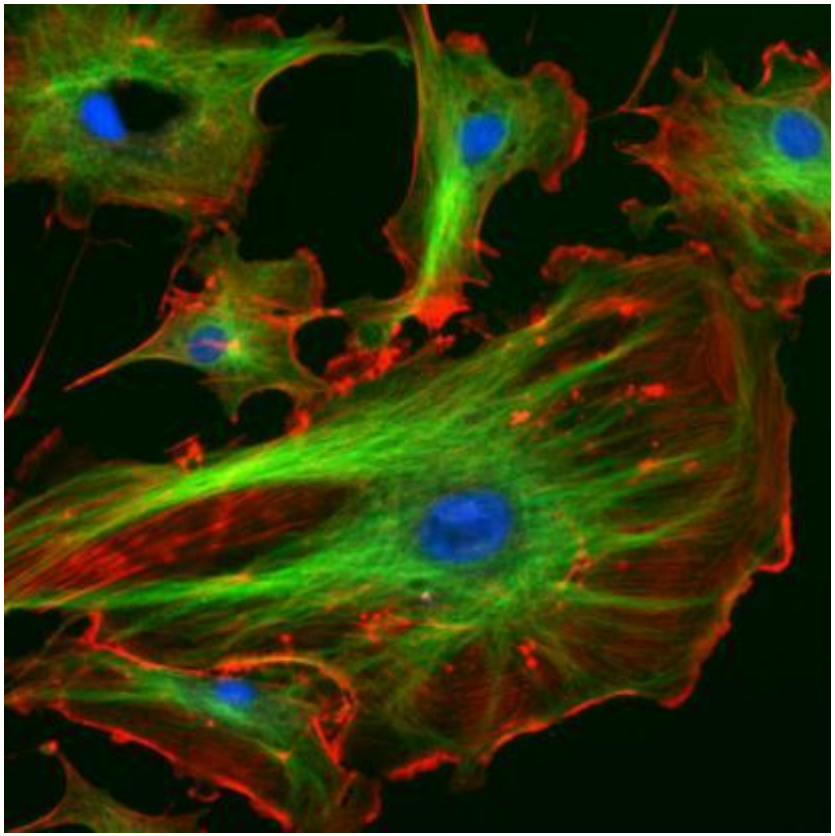
Image: Eukaryotic Cell Diagram, M. Ruiz

CYTOSKELETON

Nickname: Scaffolding & Highways

Functions: Multiple

- Maintains cell _____.
- Protects the cell.
- Enables some cell _____ (using structures such as flagella and cilia).
- Plays important roles in intra-cellular transport *(the movement of vesicles and organelles).*
- Plays important role in cellular _____.



***Q:** Eukaryotes? Prokaryotes? Both?*

Images: Fluoresced Eukaryotic Cell, NIH.

CYTOSKELETON: Microfilaments, Intermediate Filaments & Microtubules

Network of protein fibers running throughout the cytoplasm that give a cell its shape & provide a basis for movement.

1. **Micro_____**
   Two intertwined strands of actin protein.

2. **_____ Filaments**
   Fibrous proteins supercoiled into thick cables.

3. **Micro_____**
   - Hollow tubes of tubulin
   - Cell shape, cell movement, chromosome movement during division
   - "Highways" along which the organelles travel and are conveyed.
   - Microtubules may work alone, or join with other proteins to form more complex structures called **cilia**, **flagella** or **centrioles**.

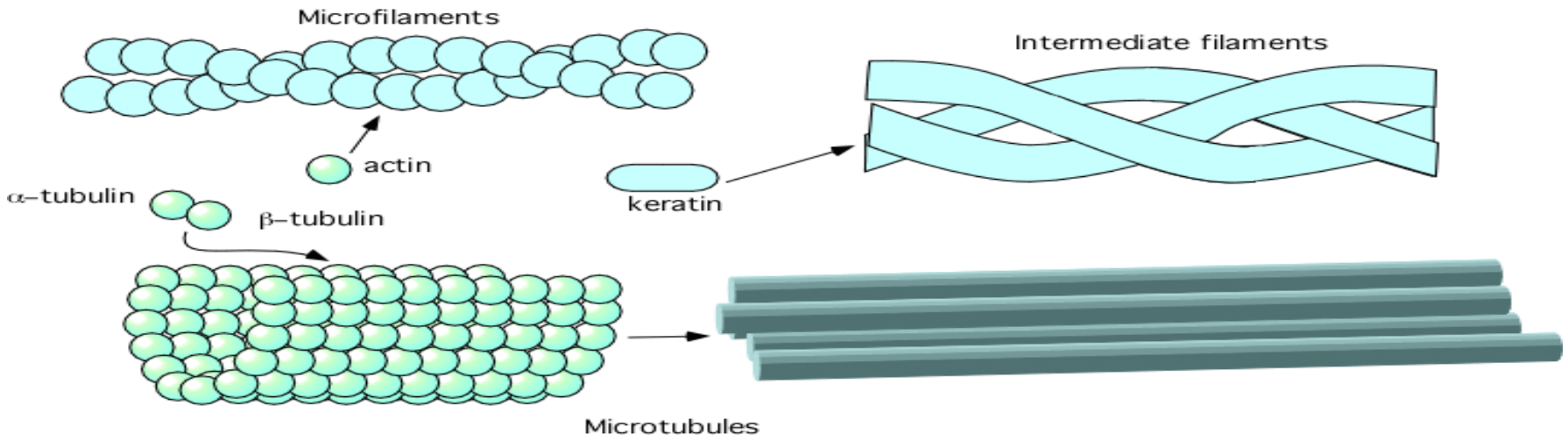


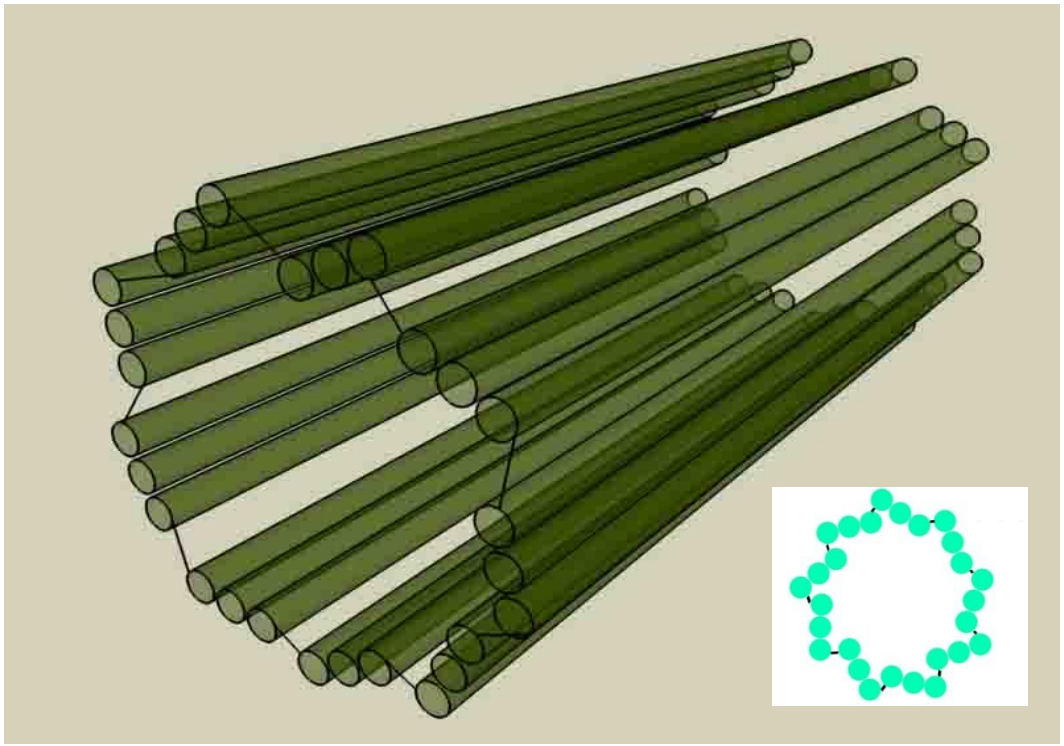
Image: Source Unknown

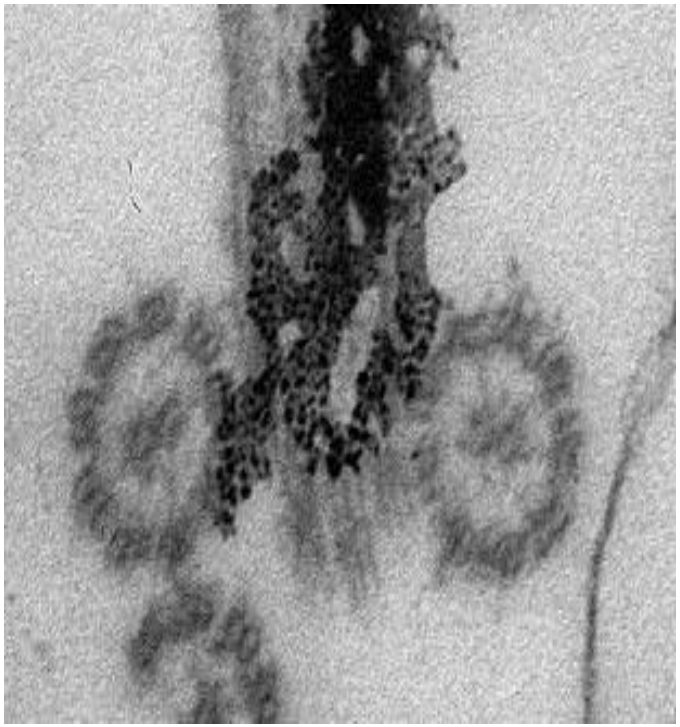
CYTOSKELETON: Centrioles & Centrosomes

The _____, also called the "microtubule organizing center", is an area in the cell where microtubles are produced.

Within the cells of animals are a pair of _____, made of nine sets of triplet microtubules.

Microtubules > Centriole > **Centrosome**

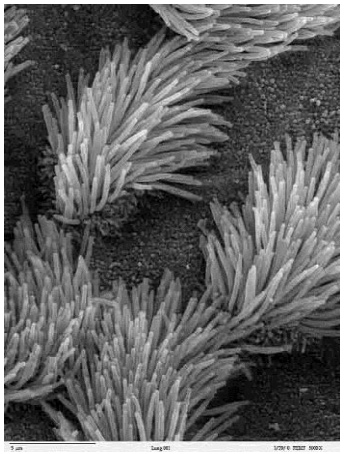


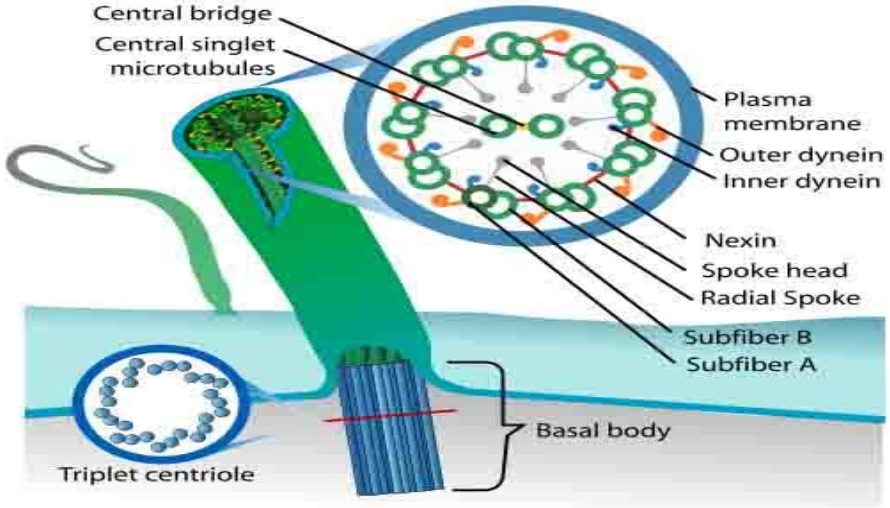


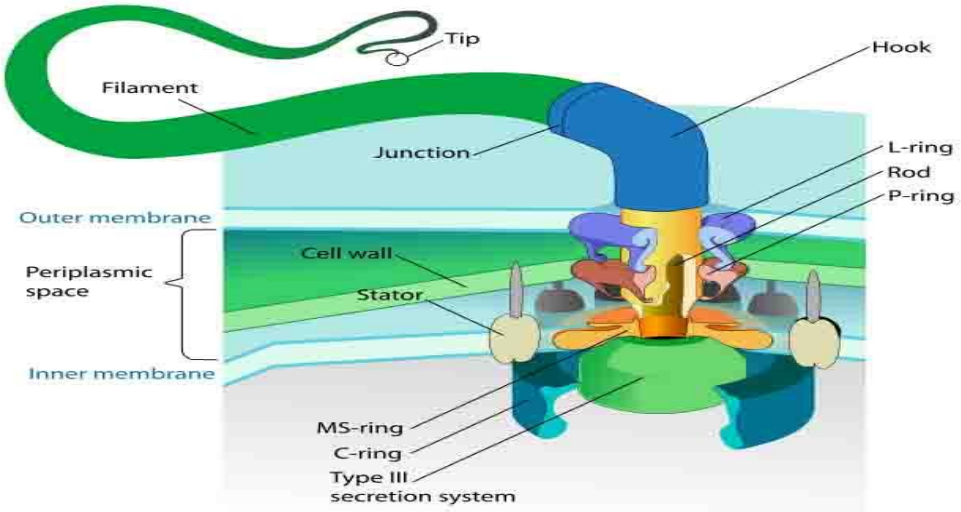
From the Virtual Cell Biology Classroom on ScienceProfOnline.com

Images: Centriole Cross-section & Centriole-3D, Twooars; Micrograph of Centrioles, Christos Chinopoulos

&





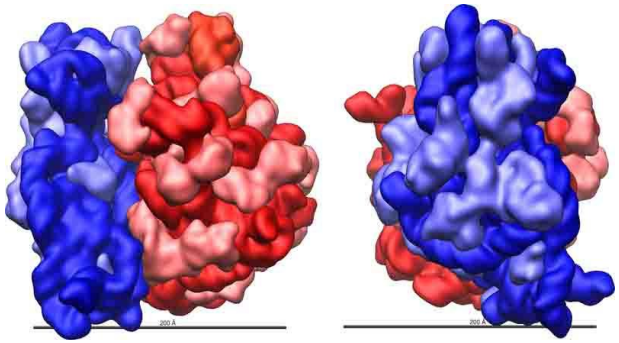


- External appendages from cell membrane.
- Aid in locomotion of the cell or movement of materials near cell.
- Motility > coordinated sliding movements of microtubules.
- Both Prokaryotes & Eukaryotes can have external appendages, but are constructed differently.
- **Eukaryotes** may have flagella or cilia (components of cytoskeleton covered with plasma membrane).
- **Prokaryotes** may have flagella, endoflagella, fimbiae or pili (composed of protenaceous molecules and not covered with plasma membrane).

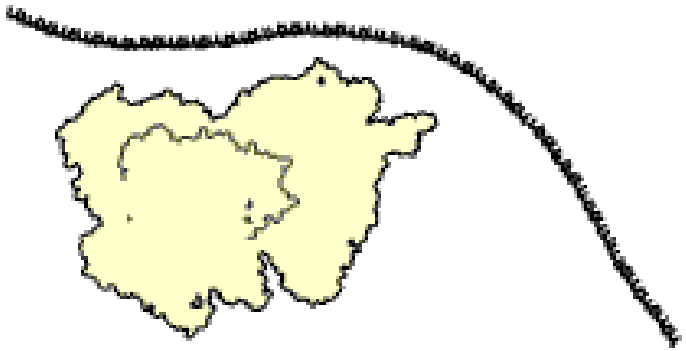
Images: Cilia of the lung trachea epithilium, Charles Daghlian, Cilum Diagram & Flagellum Diagram, M. Ruiz; Sperm & Egg, Wiki

From the Virtual Cell Biology Classroom on ScienceProfOnline.com

Ribosomes



Click here for animation of ribosome building a protein.



- ***Q:** What do they do?*
- ***Q:** What are they made of?*
- Can be found alone in the cytoplasm, in groups called **polyribosomes**, or attached to the endoplasmic reticulum.
- ***Q:** Eukaryotes? Prokaryotes? Both?*

Images: Ribosome translating protein, animation, Xvazquez; Ribosome Structure, Vossman

Membrane-bound Organelles

- Eukaryotic cells have many **organelles**.
- Prokaryotes only have ribosomes, which are not bound by a membrane.
- Membrane-bound eukaryotic organelles **organize** functions within the cell.

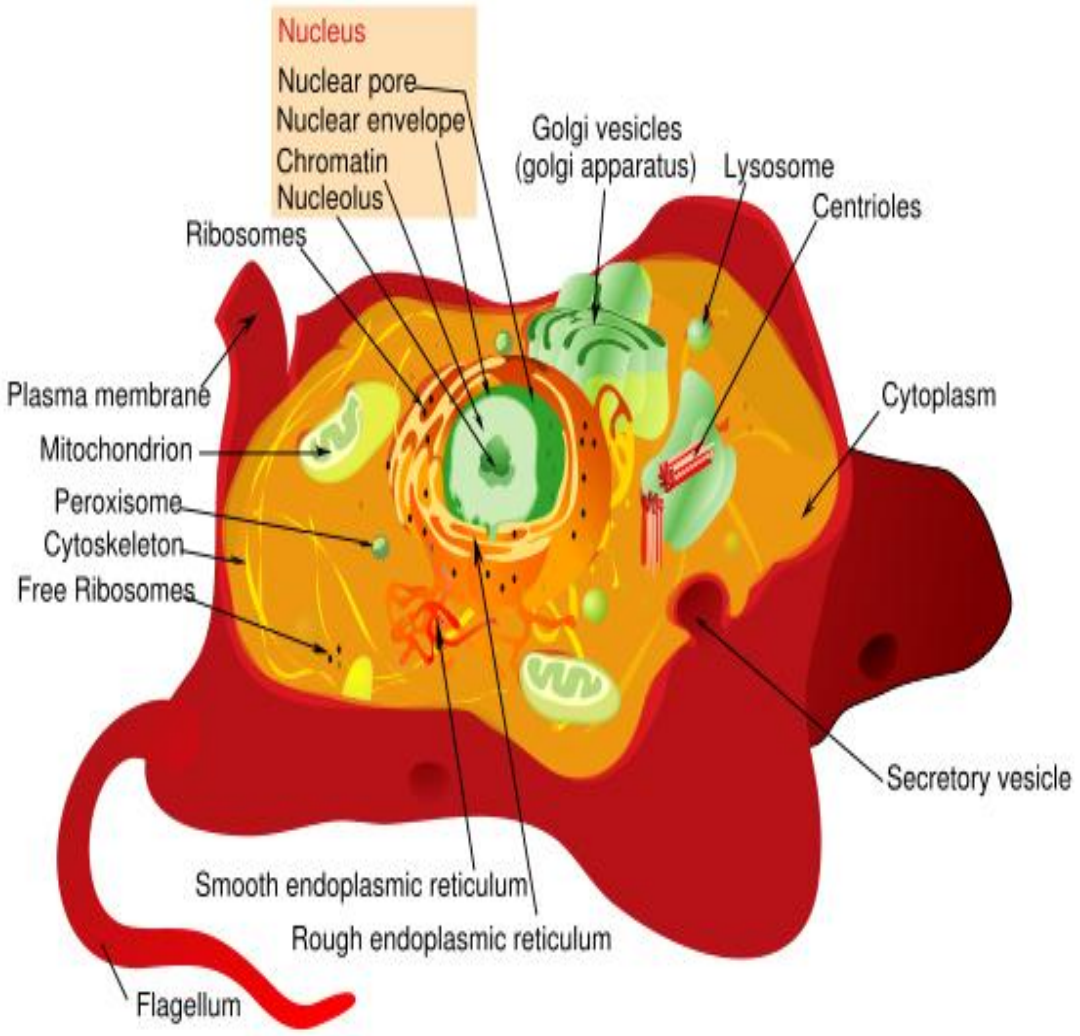


Image: Eukaryotic Cell Diagram, M. Ruiz

System of internal membranes within eukaryotic cells that divide the cell into compartments, or organelles.

Transport system, for moving molecules through interior of cell, as well as interactive surfaces for lipid and protein synthesis.

Membranes of the endomembrane system are made of a lipid bilayer, with proteins.

The Endomembrane System consists of:

1. _____
2. _____ _____
3. _____ _____
4. _____
5. _____
6. _____ _____

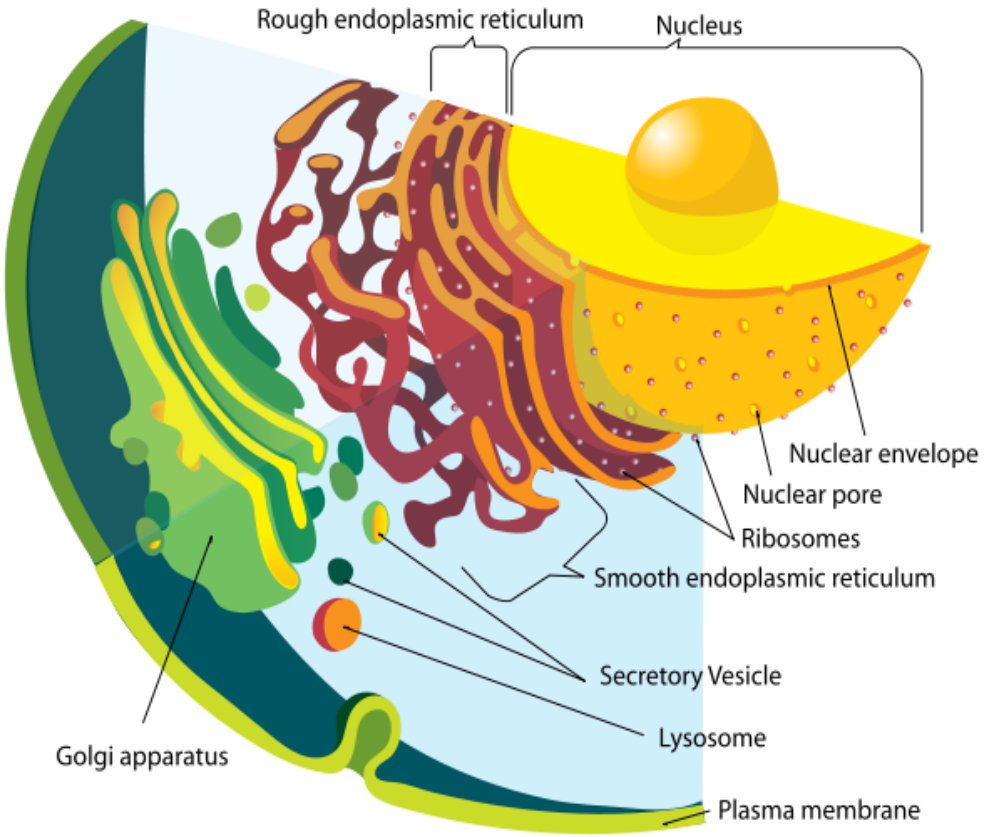
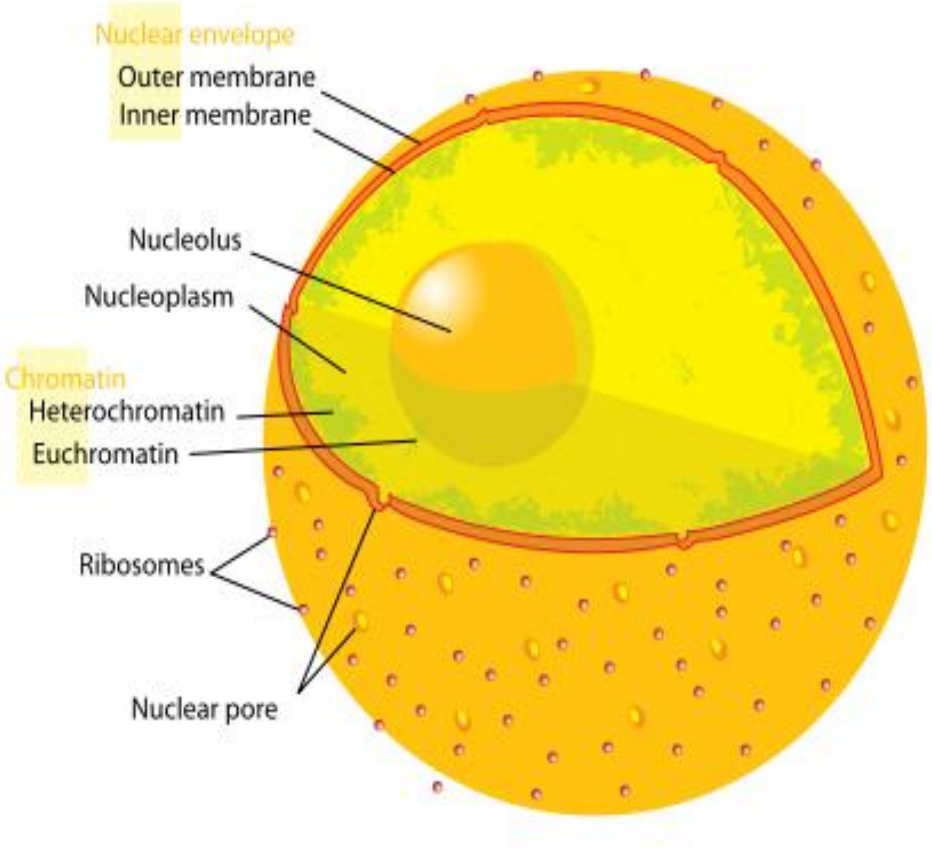


Image: Endomembrane system diagram, M. Ruiz

ENDOMEMBRANE SYSTEM ORGANELLES:
Nucleus



Nickname: Control Center

Function: Separates the genetic material (DNA) from the rest of the cell.

- DNA, the genetic material, is a blueprint, or code for making ***proteins***.

- _____ _____ is the double membrane structure that separates nucleus from cytoplasm.

Images: Endomembrane system diagram,& Nucleus diagram, M. Ruiz

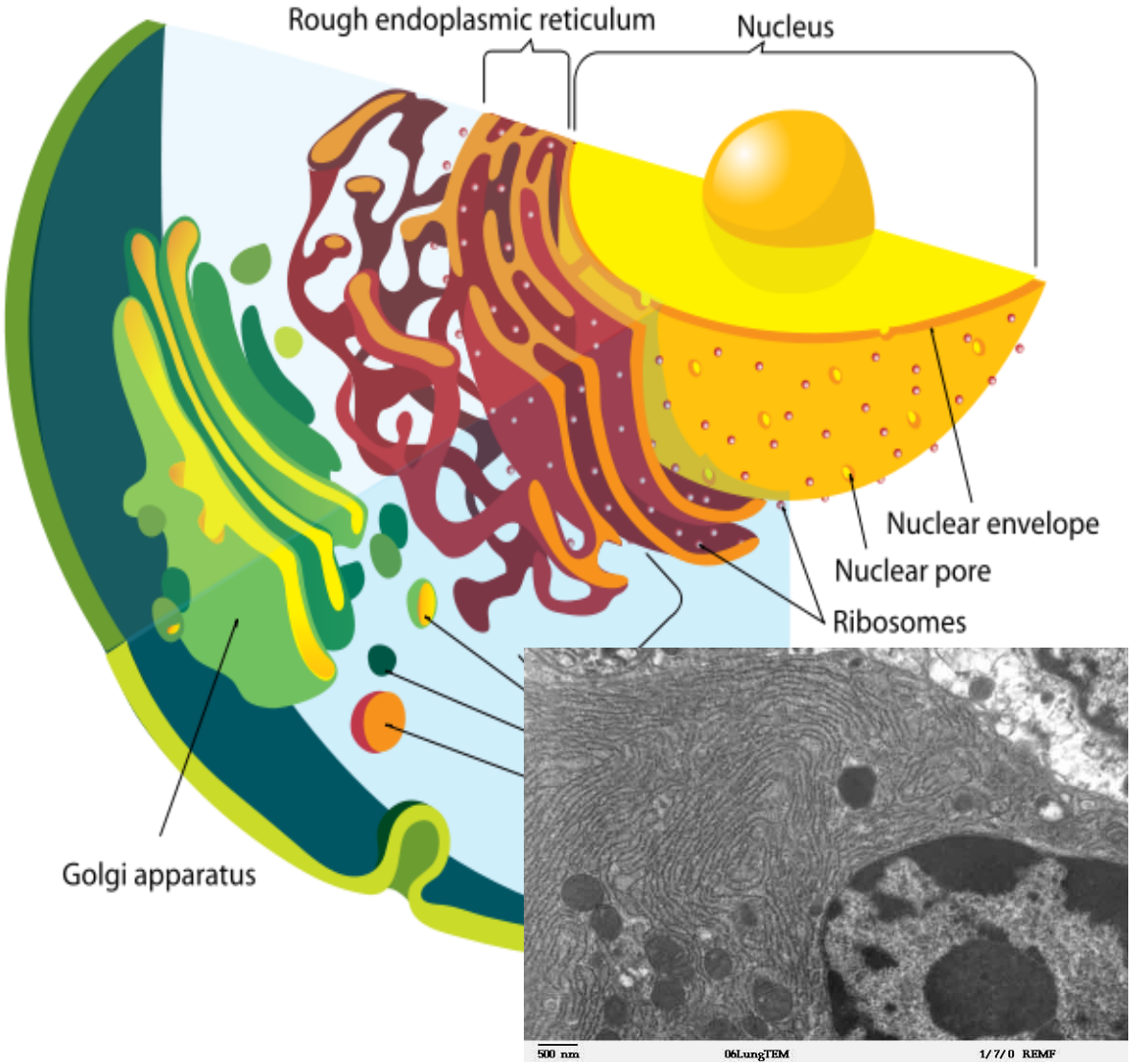
ENDOMEMBRANE SYSTEM ORGANELLES:

Endoplasmic Reticulum

Nickname:
Production Factory
(makes proteins and lipids)

Function: Internal production & delivery system of the cell.

- System of membranous channels and vesicles.
- _____ is studded with ribosomes. Site of protein synthesis and processing.
- _____ lacks ribosomes. Site of synthesis of phospholipids and packaging of proteins into vesicles.



Images: Endomembrane system diagram, M. Ruiz, ER photomicrograph, Louisa Howard.

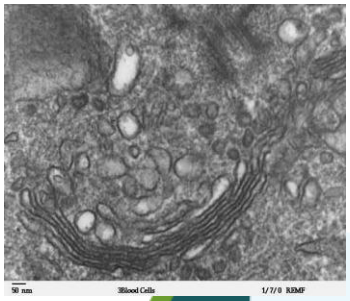
ENDOMEMBRANE SYSTEM ORGANELLES :

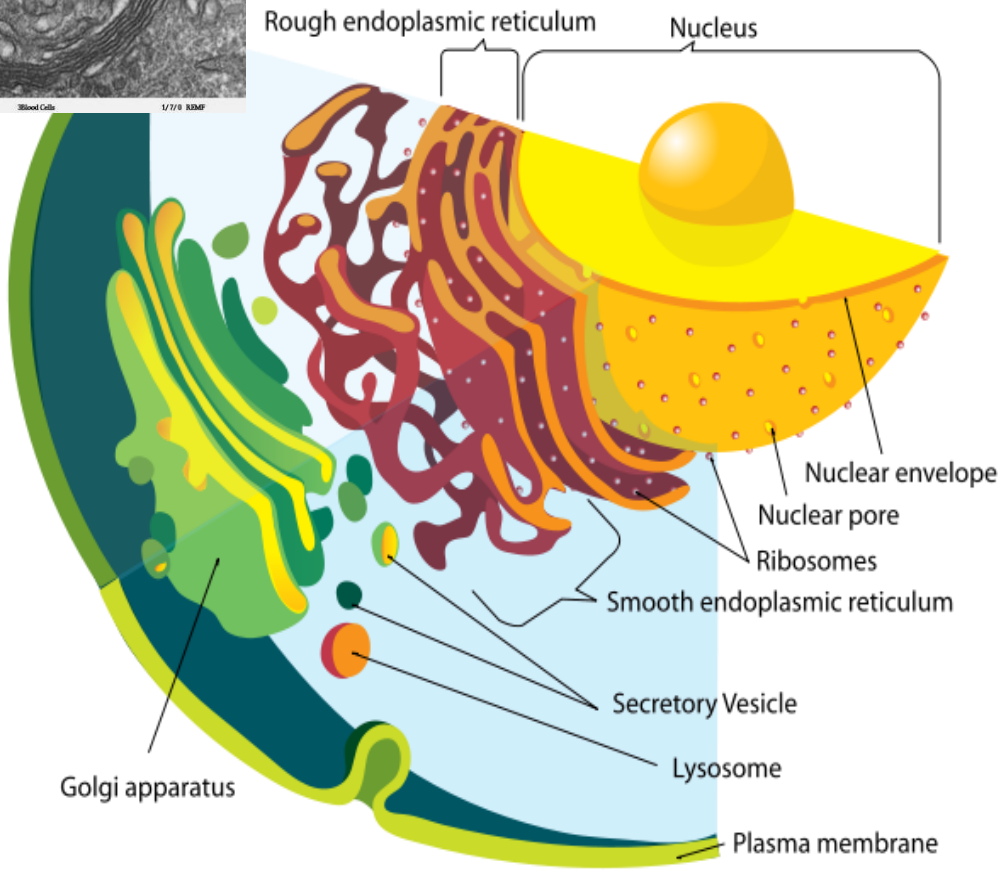
Nickname:
Assembly Factory

Functions:

- Takes simple molecules and puts them together into more complex macromolecules.
- Packages, modifies, and transports materials to different location inside/outside of the cell.

Appearance: Stack of pancakes.

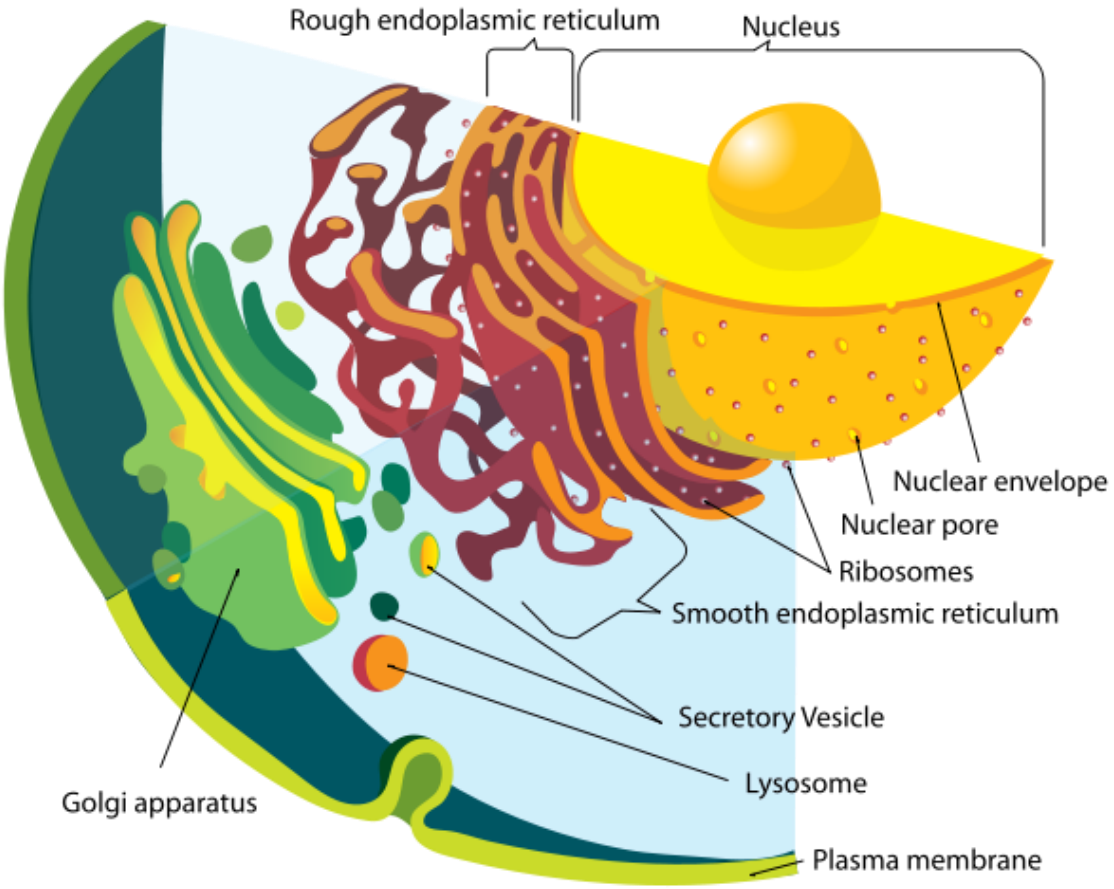




- Consists of a stack of curved saccules.
- Receives protein and also lipid-filled vesicles from the ER, packages, processes, and distributes them *within the cell* or for *export out of the cell (secretion)*.
- Also encloses digestive enzymes into membranes to form lysosomes.

Images: Endomembrane system diagram, M. Ruiz, Golgi apparatus photomicrograph, Louisa Howard.

ENDOMEMBRANE SYSTEM ORGANELLES:



Nickname: The Trucks

Function: Store, transport, or digest cellular products and waste.

- Small compartments separated from the cytosol by at least one lipid bilayer.
- Made in Golgi apparatus, ER, or from parts of the plasma membrane.
- Vesicles form while taking in (_____) or discharging (_____) materials.

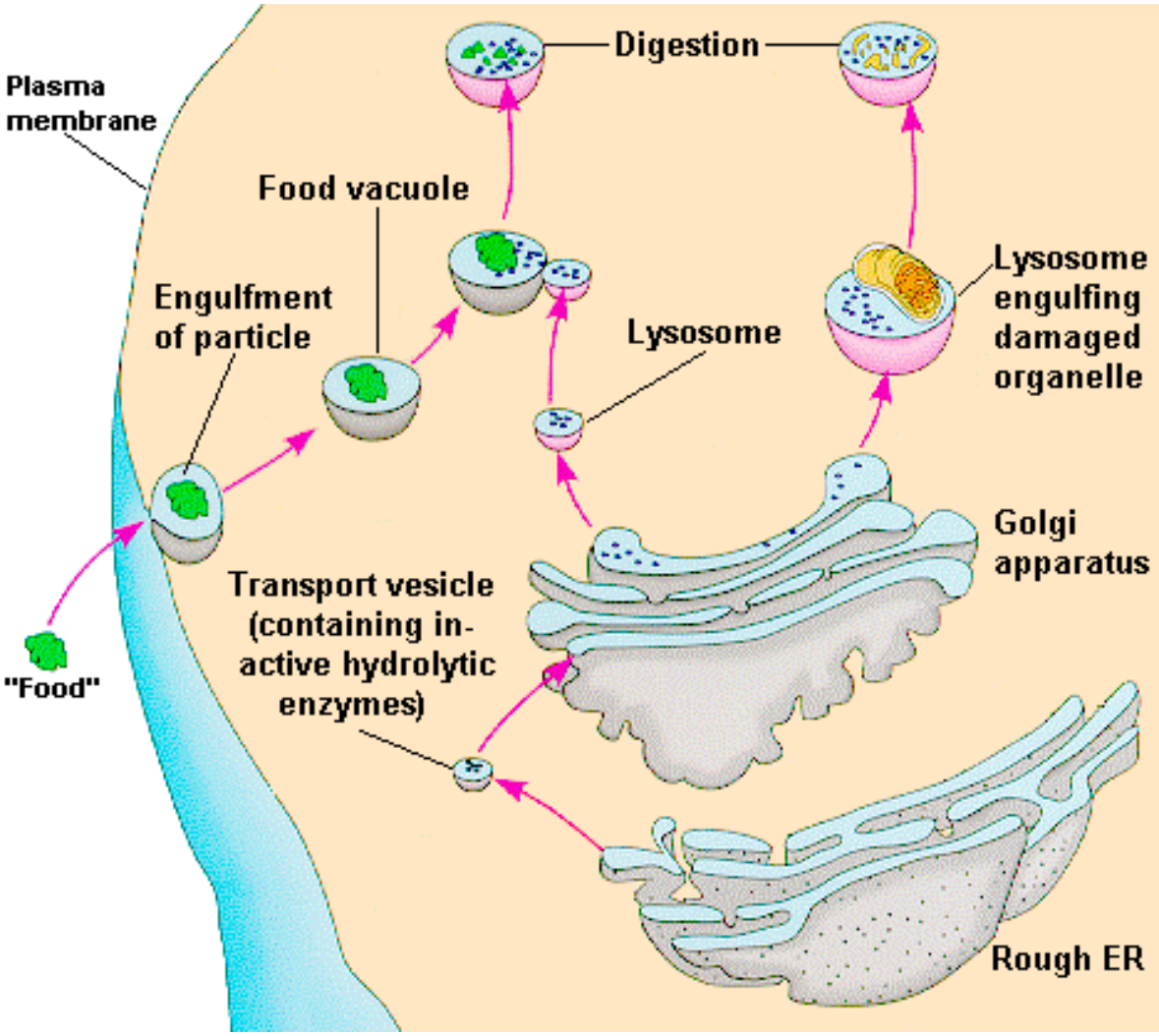
Image: Endomembrane system diagram, M. Ruiz

ENDOMEMBRANE SYSTEM ORGANELLES:

Nickname: Recycling Trucks

Function: Breaks down food into particles and to destroys old cellular components.

- *Q: Which organelle produces lysosomes?*
- Contain hydrolytic enzymes and are involved in intracellular digestion.



Images: Endomembrane system diagram, M. Ruiz, Lysosome action diagram, Encyclopedia of Science

ENDOMEMBRANE SYSTEM ORGANELLES:

- ***Q:*** *What is it made of?*
- ***Q:*** *What is its function?*

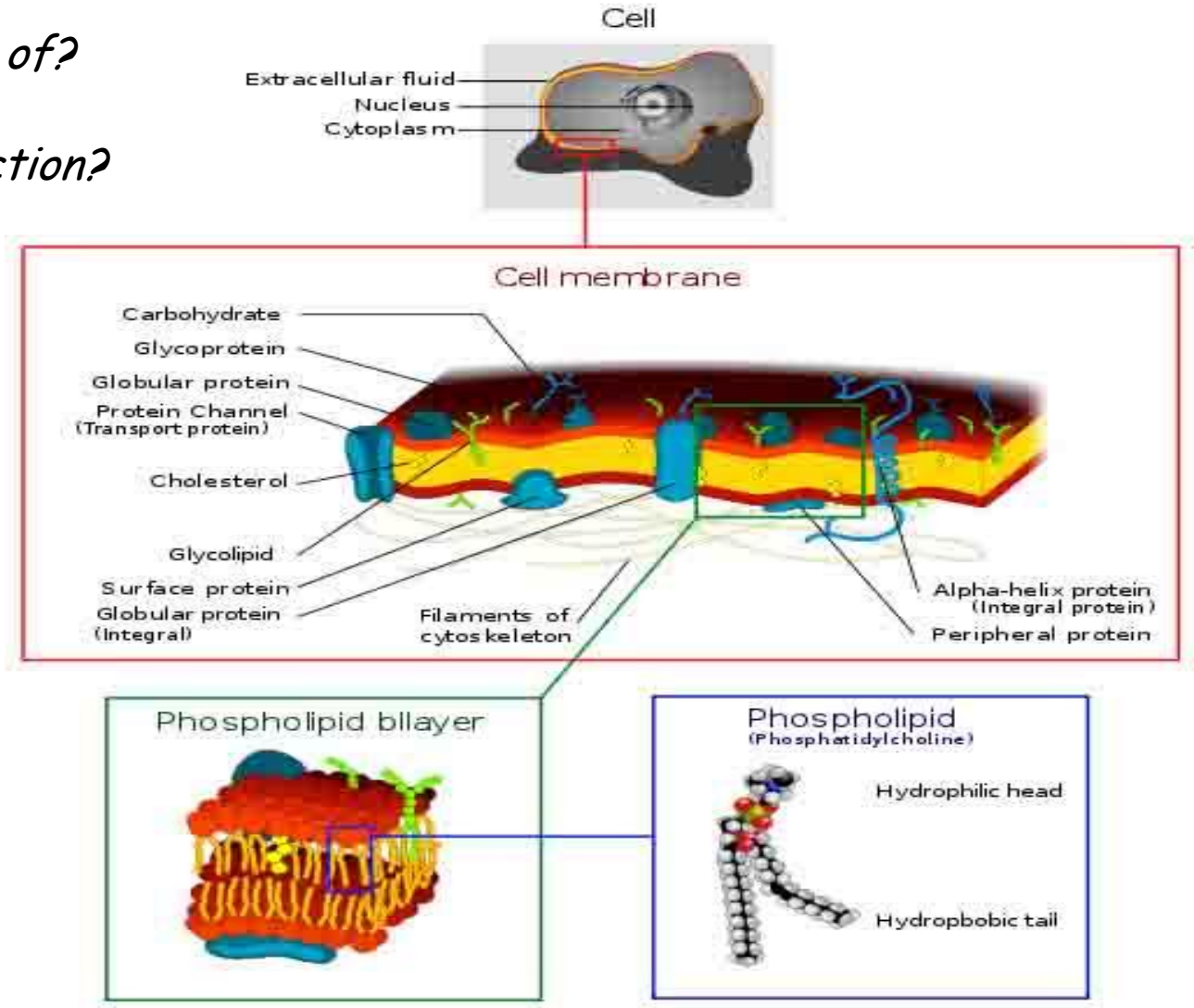


Image: Endomembrane system diagram, M. Ruiz Cell Membrane diagram, Wiki

Endomembrane System

Let's watch an animation on endocytosis & exocytosis!

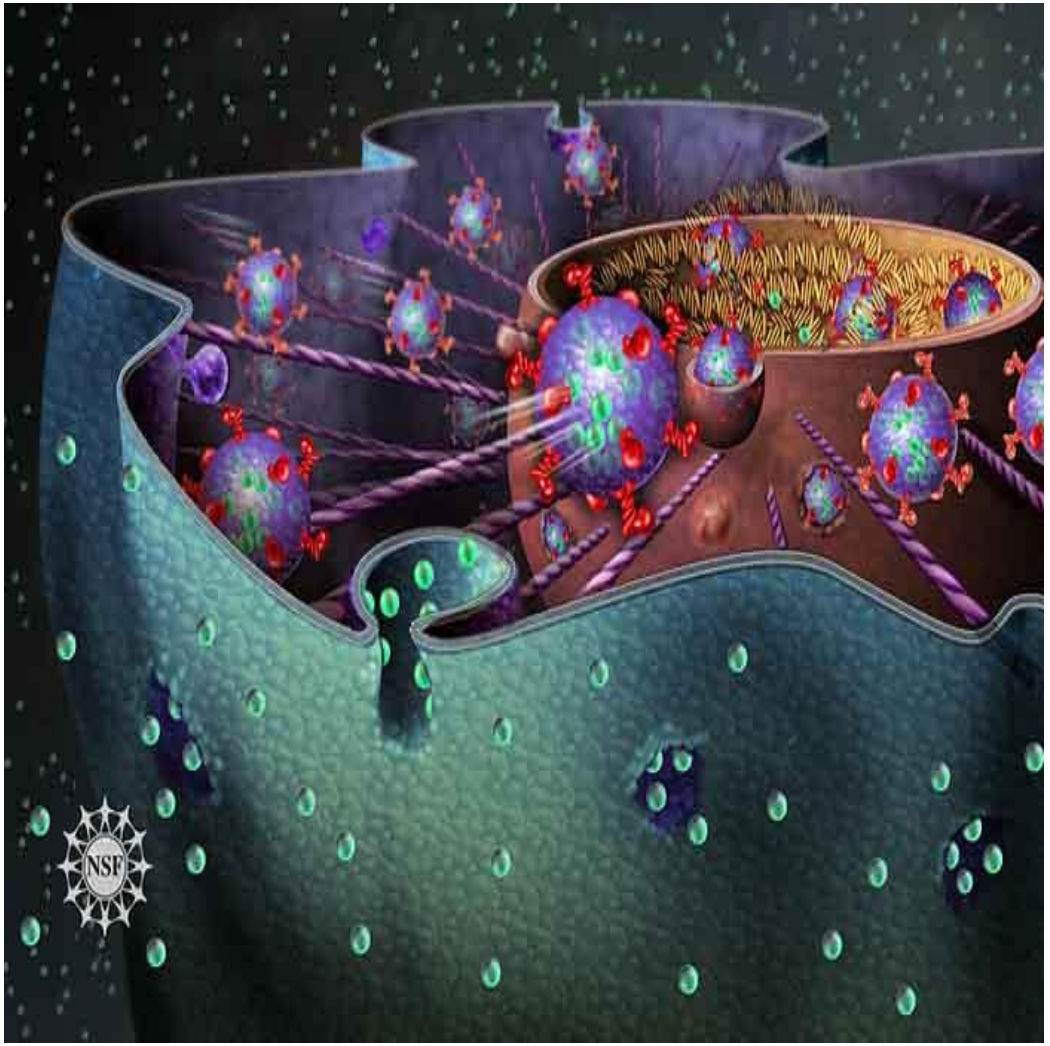


Image: Endocytosis / Exocytosis, Nicolle Rager Fuller

From the Virtual Cell Biology Classroom on ScienceProfOnline.com

Endomembrane System

1. Nuclear envelope
2. Endoplasmic reticulum
3. Golgi apparatus
4. Vesicles
5. Lysozomes
6. Plasma Membrane

Image: Endomembrane system, M. Ruiz

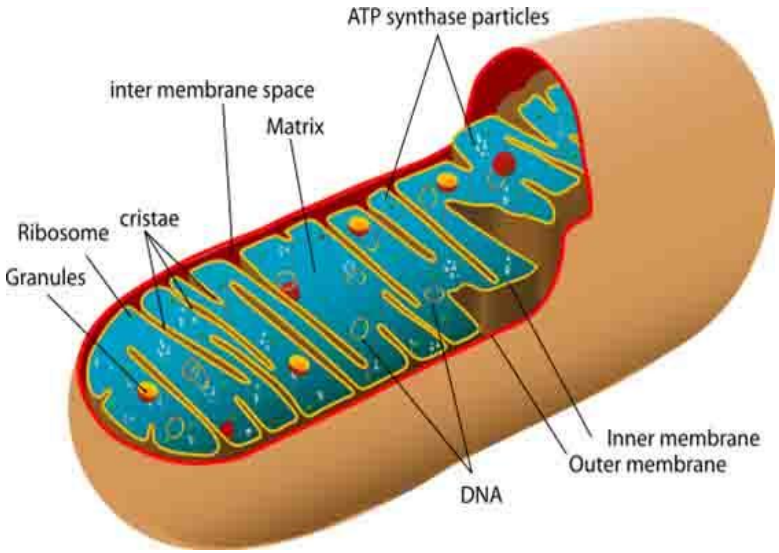
Organelles: Energy-Related

_____

&

_____

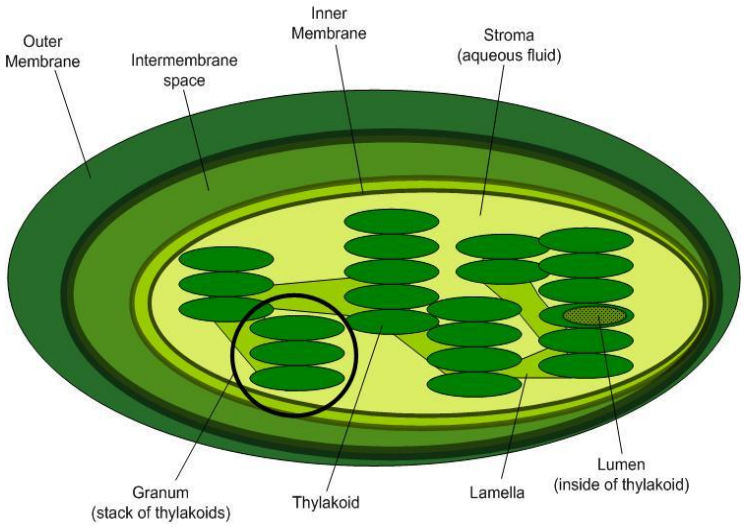
Found in nearly all eukaryotes →



- Both organelles house energy in the form of ATP.

- Both ancestrally were independent cells that formed a symbiotic relationship with other cells.

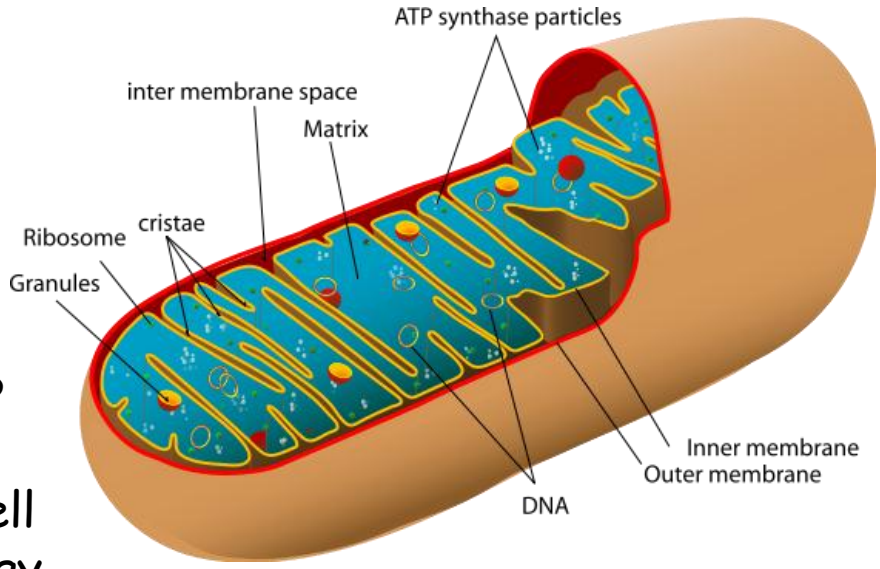
Found in plants & algae & some microbes →



From the Virtual Cell Biology Classroom on ScienceProfOnline.com

Images: Mitochondrion diagram M. Ruiz; Chloroplast diagram, Wiki

ENERGY-RELATED ORGANELLES:
Mitochondria

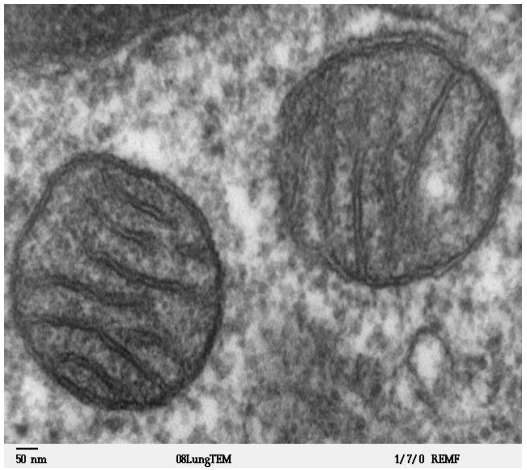


Nickname: The Powerhouse

Function: Energy formation
Breaks down food to make ATP

ATP is the major fuel for all cell activities that require energy

- Bound by a double membrane surrounding fluid-filled matrix.
- The inner membranes of mitochondria are _____.
- The _____ contains enzymes that break down carbohydrates and the cristae house protein complexes that produce ATP.



From the Virtual Cell Biology Classroom on ScienceProfOnline.com

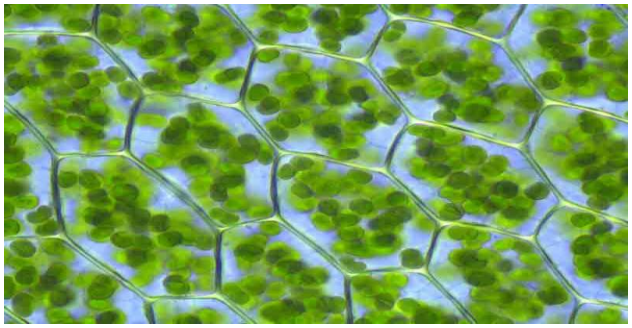
Images: Mitochondrion diagram M. Ruiz; Mitochondria photomicrograph, Louisa Howard

Now let's learn about additional structures found in

PLANT Cells

Images: All images by T. Port

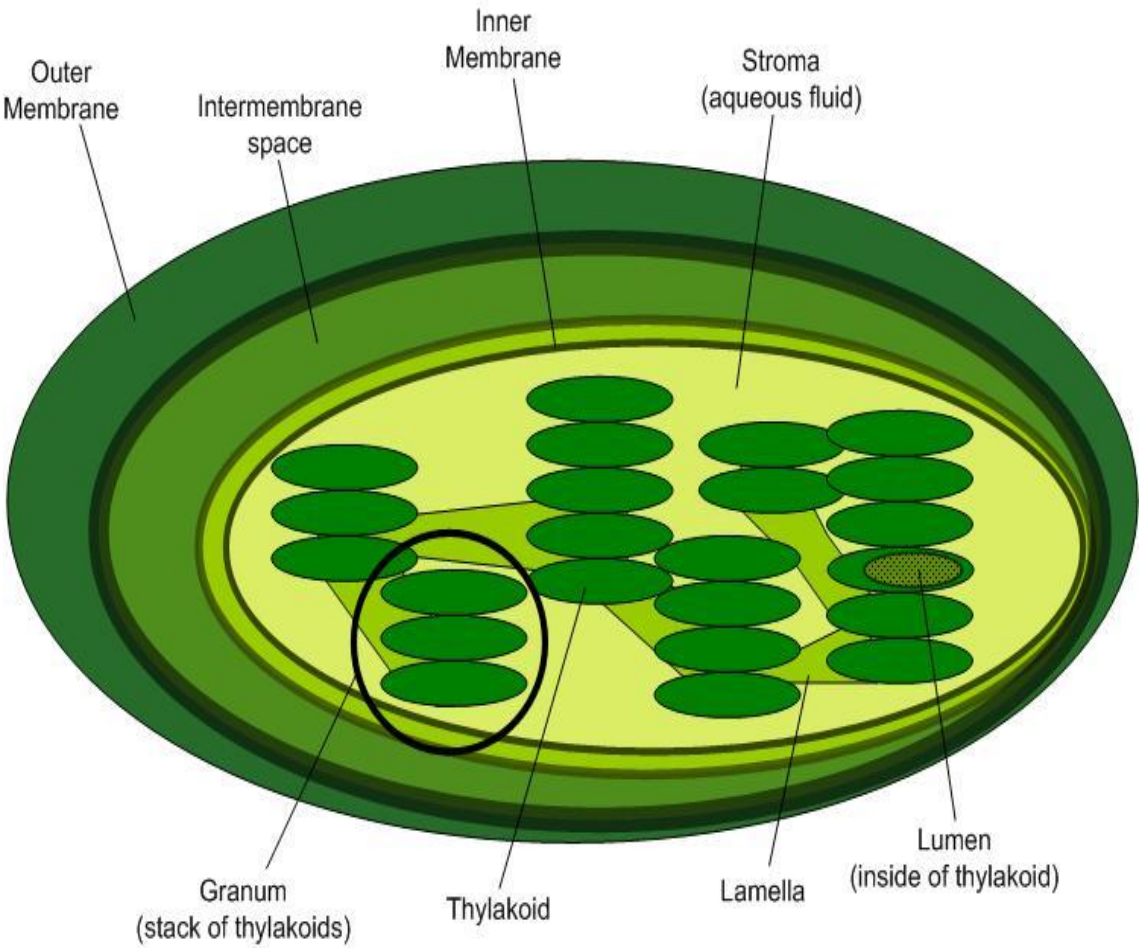
ENERGY-RELATED ORGANELLES:
Chloroplasts



Nickname: Solar Panels

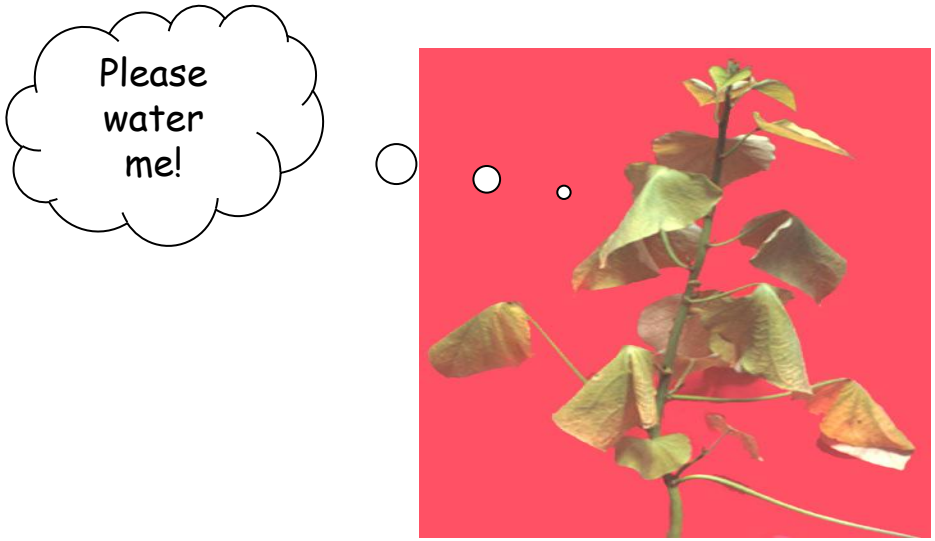
Function: Captures Sunlight Energy & Makes ATP

_____ (a green pigment) absorbs solar energy and carbohydrates are made in the stroma.



Images: Plant cells with chloroplasts, Kristian Peters, Chloroplast diagram, Wiki

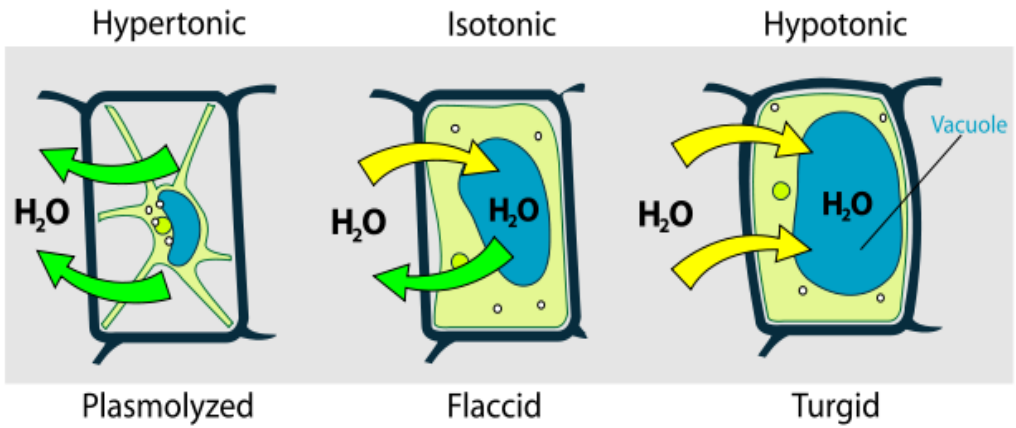
PLANT CELL: _____

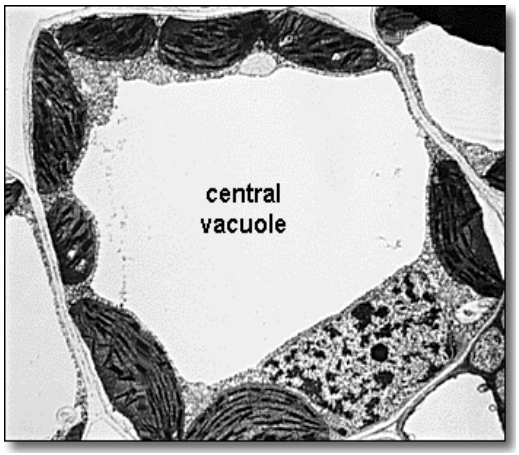


Nickname: Reservoir

Function: Stores water

- This is what makes lettuce crisp.
- When there is no water, the plant wilts.

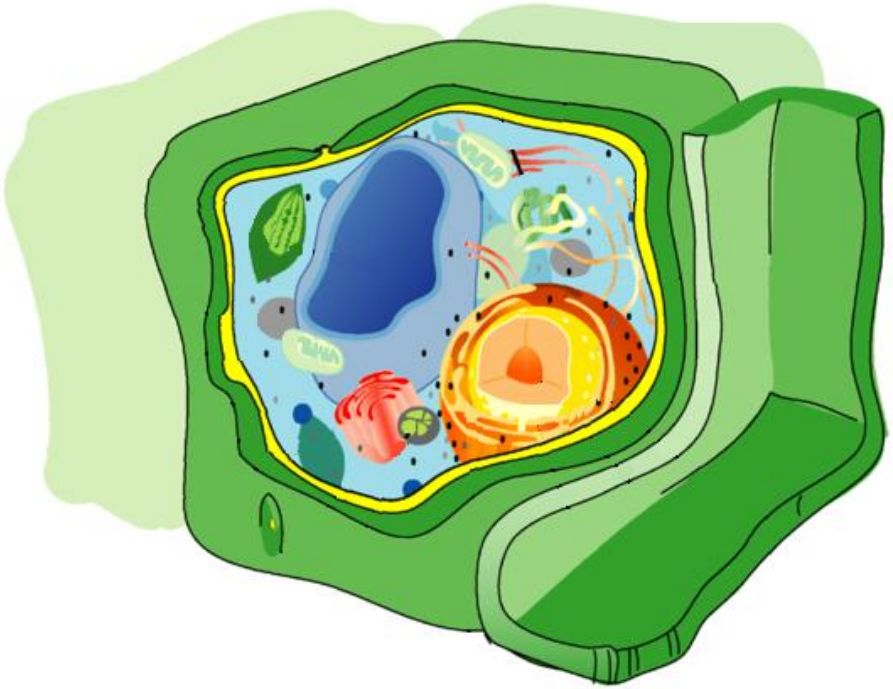




From the Virtual Cell Biology Classroom on ScienceProfOnline.com

Images: Osmosis Plant Cell, M. Ruiz; Other Images Source Unknown

PLANT CELLS: _____ _____

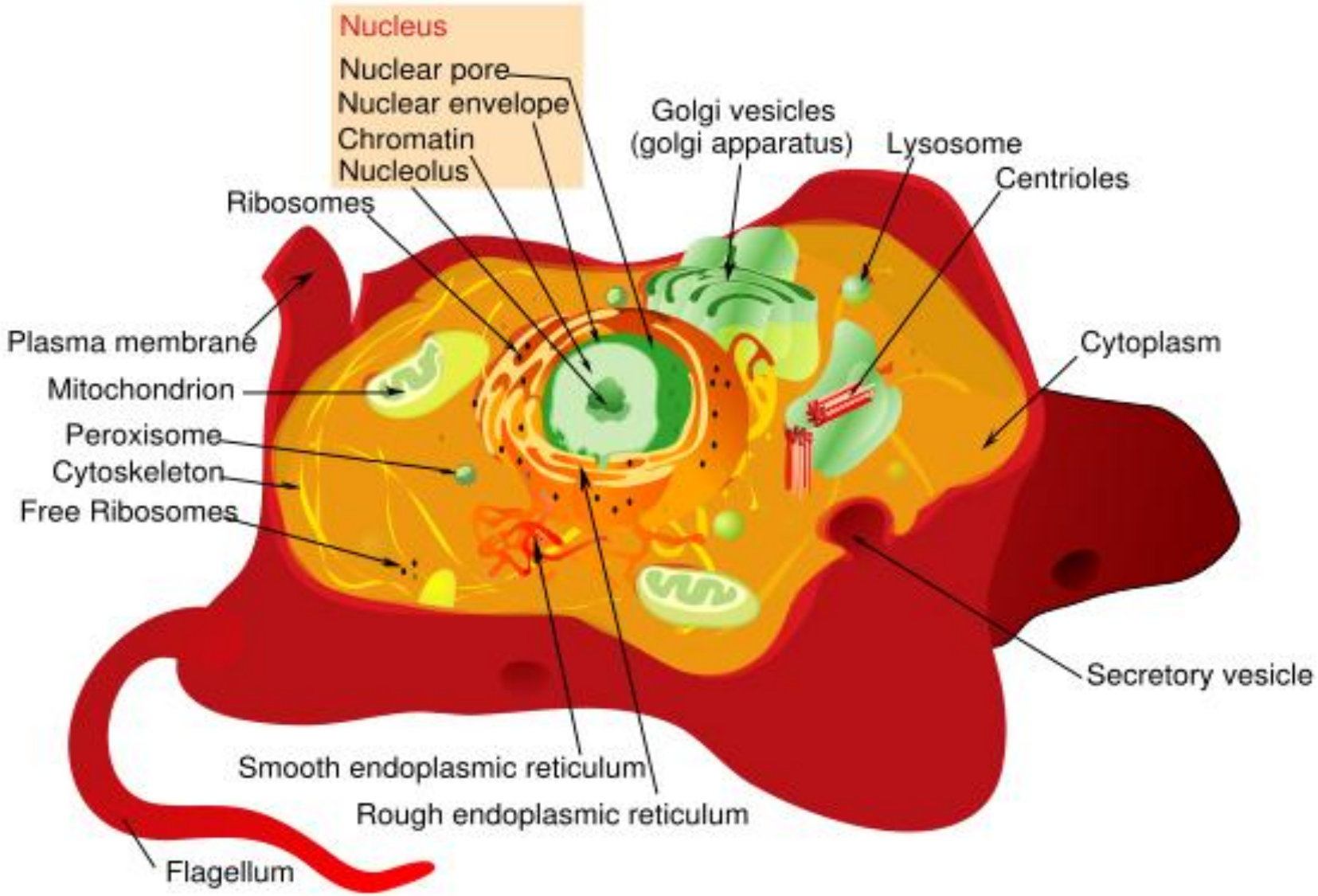


Function: Provides support and protection to the cell membrane

Found outside the cell membrane in plant cells

Images: Plant cell, M. Ruiz

Animal Cell *(Eukaryote)*



Plant Cell *(Eukaryote)*

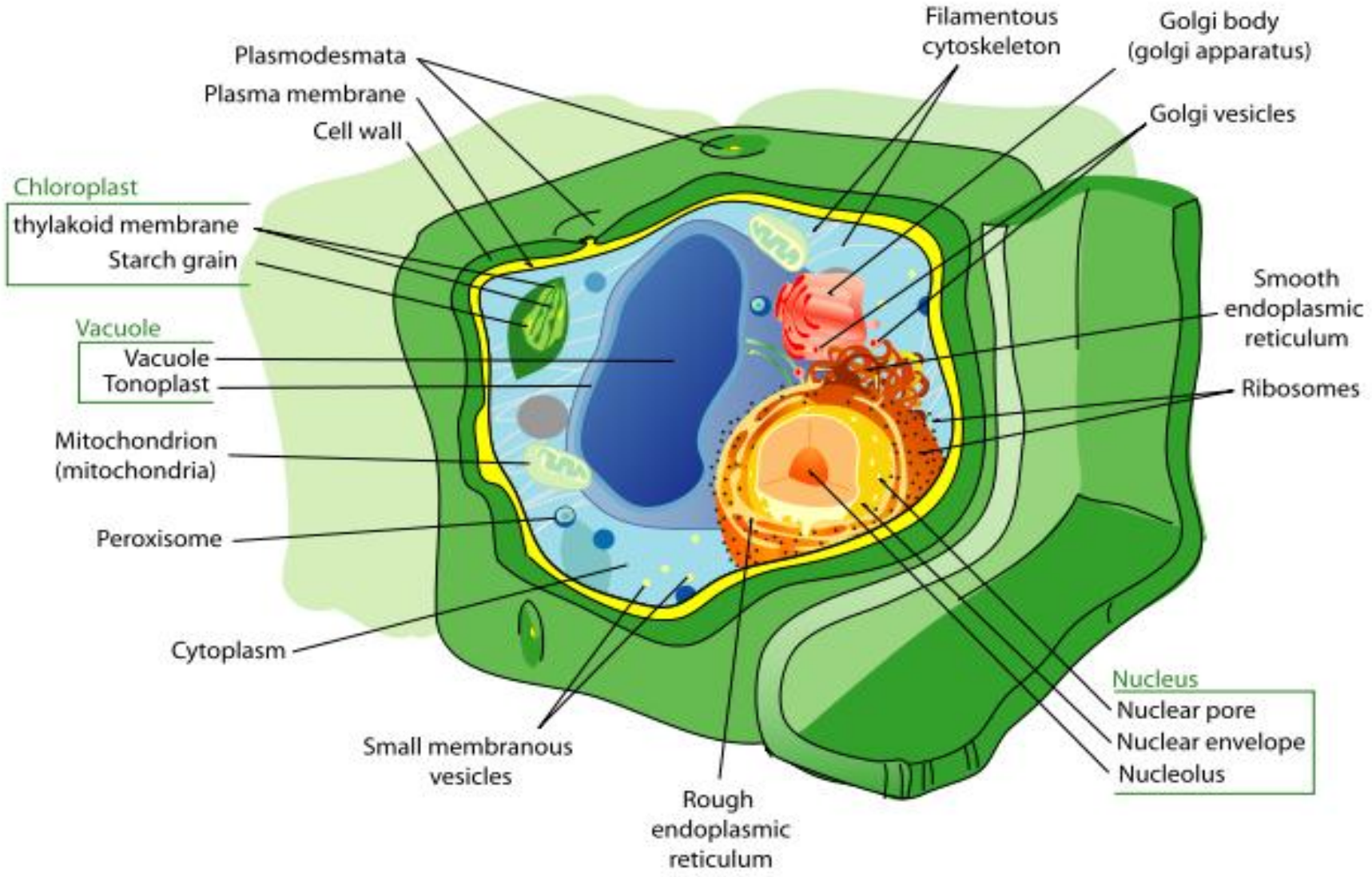


Image: Plant cell diagram, M. Ruiz

Confused?

Here are some links to fun resources that further explain Cell Biology:

Smart Links

- Eukaryotic Cells Main Page on the Virtual Cell Biology Classroom of Science Prof Online.
- Prokaryotic & Eukaryotic: Two Types of Biological Cells, an article from SPO.
- Eukaryotic Cell: Structures, Functions & Diagrams, an article from SPO.
- "Cells" music video by They Might Be Giants.
- Cells Alive interactive website.
- "Golgi Apparatus" song by Phish
- Cell Structure tutorials and quizzes from Interactive Concepts in Biochemistry.
- Eukaryotic Cell Tour an Animated Science Tutorial.
- Endomembrane System animation and quiz.
- "The Cell Song" lyrics by The Cell Squad, Freedom Middle School, Nashville, TN.
- Endocytosis / Exocytosis animation and quiz from McGraw Hill.
- Evolution of the Three Domains Animated Science Tutorial.
- Biology4Kids – Cell Biology Main Page by Raders.

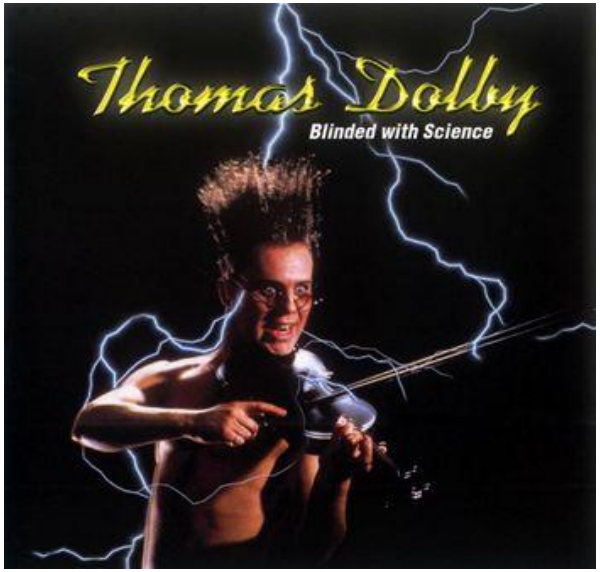
(You must be in PPT slideshow view to click on links.)

Assignment

See the ScienceProfOnline Virtual Cell Biology Classroom: **Eukaryotic Cells** lecture for a printable Word .doc of this assignment.

- At the end of some lectures, I will give you some type of in-class assignment or homework to evaluate your understanding of today's topic.
- This assignment will always be open-book.
- Today you may be completing an *activity* on the topic of **Eukaryotic Cell Structure & the Endomembrane System**.

Image: Endomembrane system, M. Ruiz



Are you feeling blinded by science?

Do yourself a favor. Use the...

Virtual Cell Biology Classroom *(VCBC)*!

The VCBC is full of resources to help you succeed, including:

- practice test questions
- review questions
- study guides and learning objectives
- PowerPoints on other topics

You can access the VCBC by going to the Science Prof Online website
www.ScienceProfOnline.com

Images: Blinded With Science album, Thomas Dolby; Endomembrane system, Mariana Ruiz, Wiki