



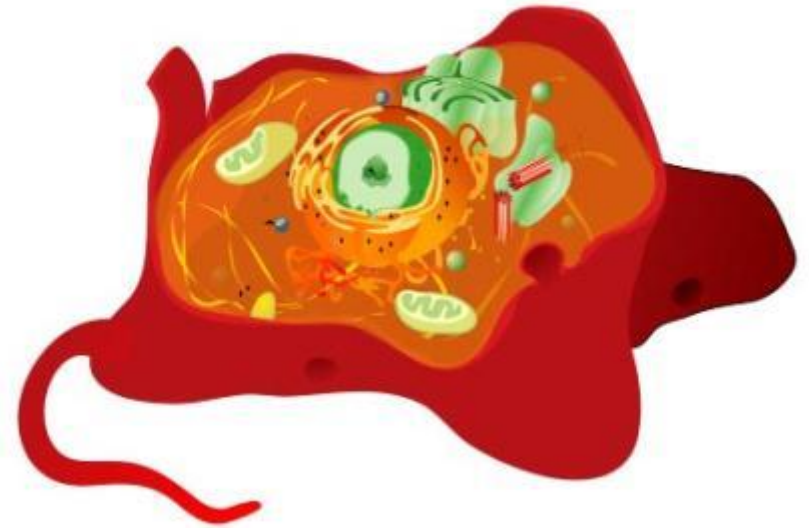
About Science Prof Online PowerPoint Resources

- Science Prof Online (SPO) is a free science education website that provides fully-developed Virtual Science Classrooms, science-related PowerPoints, articles and images. The site is designed to be a helpful resource for students, educators, and anyone interested in learning about science.
- 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.
- This digital resource is licensed under Creative Commons Attribution-ShareAlike 3.0:
<http://creativecommons.org/licenses/by-sa/3.0/>

Alicia Cepaitis, MS
Chief Creative Nerd
Science Prof Online
Online Education Resources, LLC
alicia@scienceprofonline.com

Tami Port, MS
Creator of Science Prof Online
Chief Executive Nerd
Science Prof Online
Online Education Resources, LLC
info@scienceprofonline.com

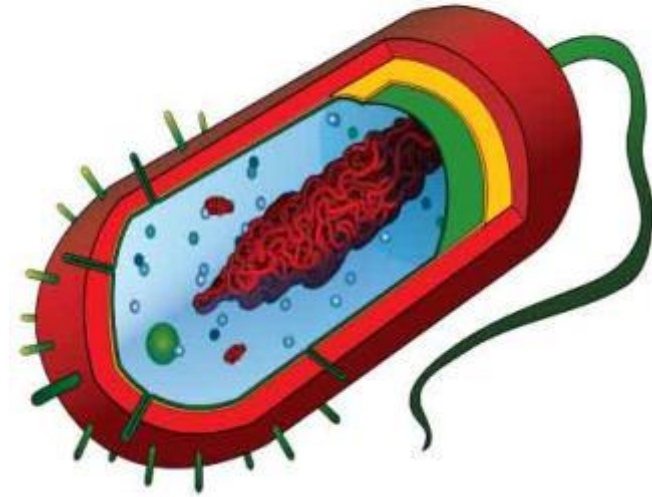
Eukaryotic Cell Structure & Function



Two Basic Types of Cells

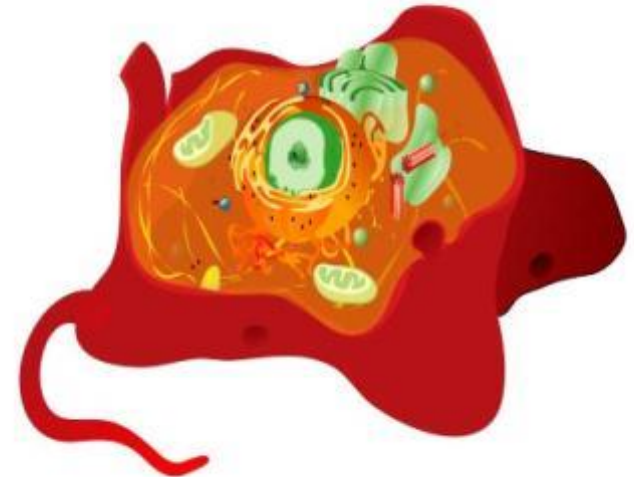
Prokaryotes

- 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.

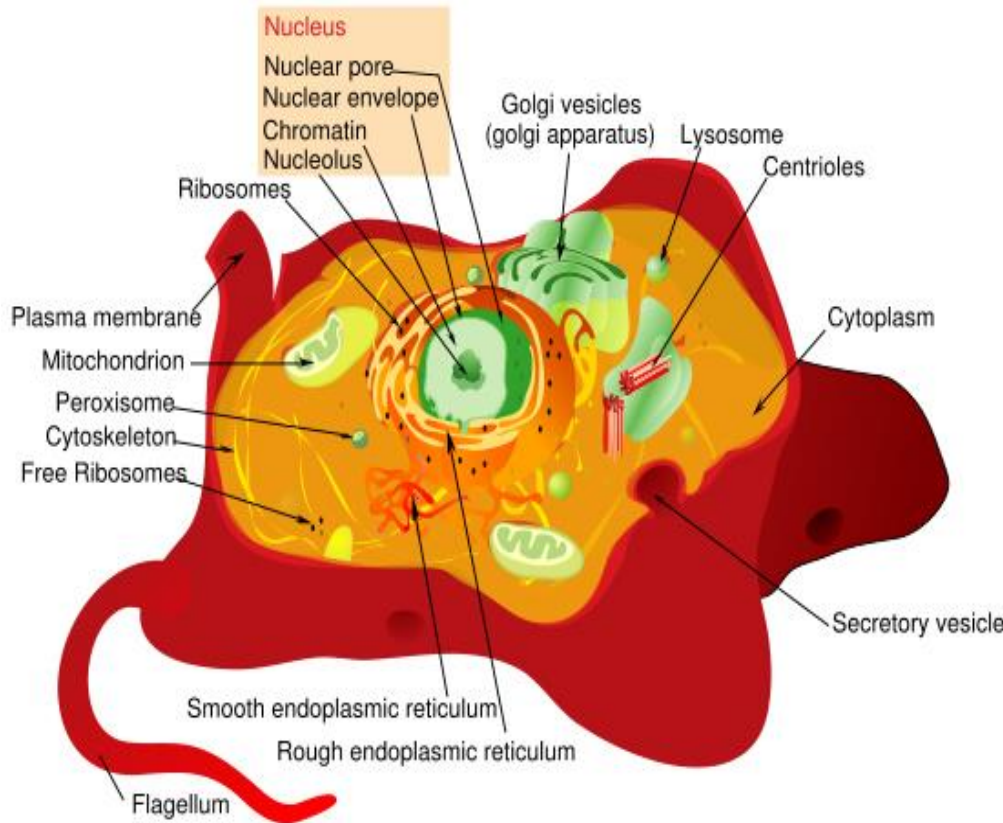


Eukaryotes

- 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.

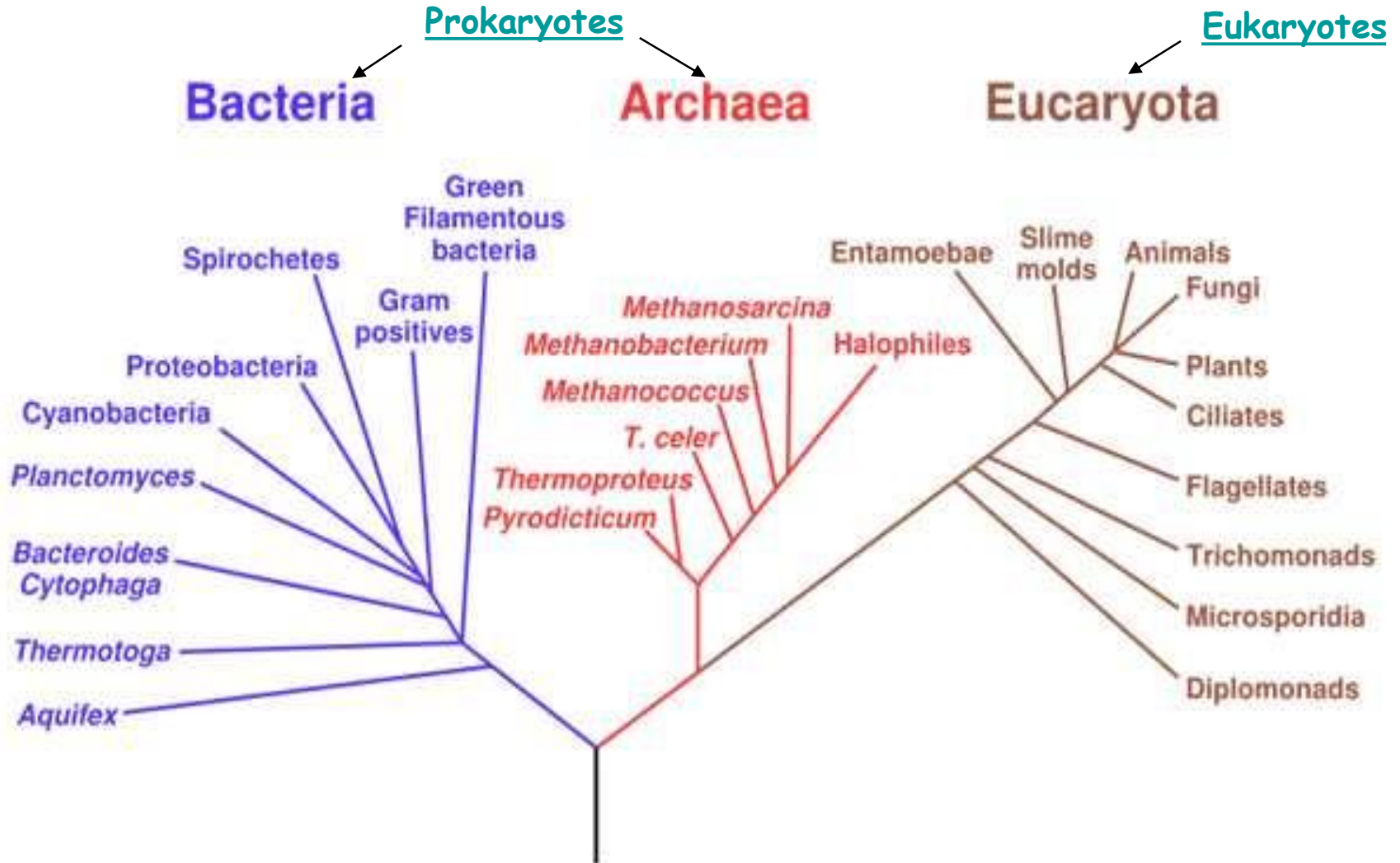


Eukaryotic Cells



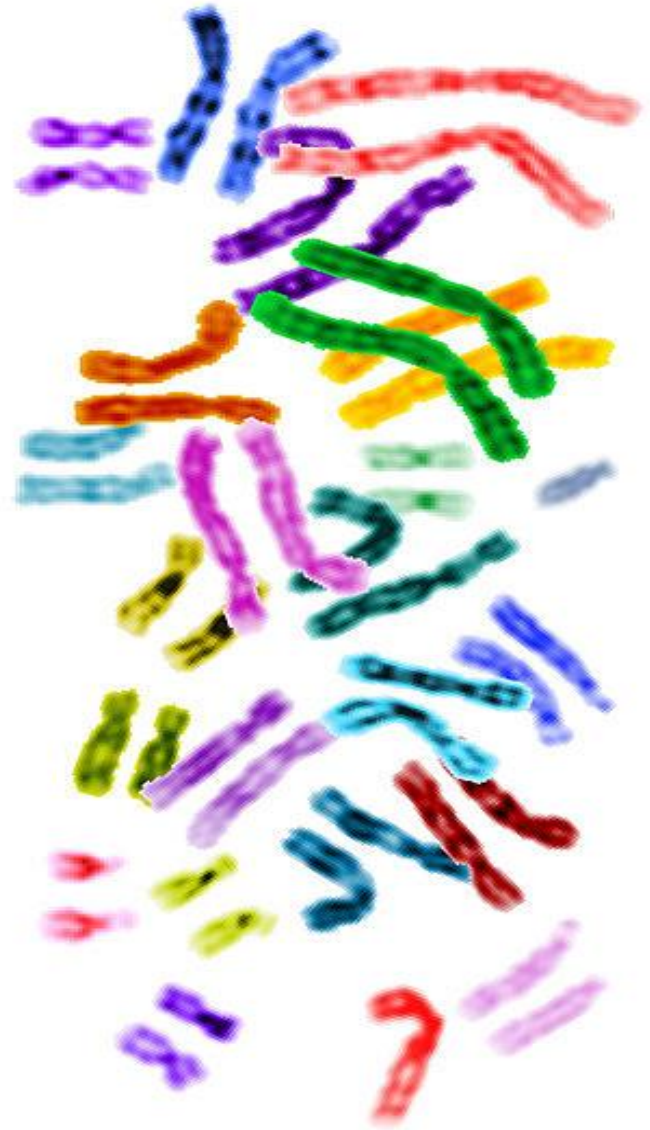
- Eu = "true", karyon = "nucleus"
- Genetic material contained in a nuclear membrane.
- Membrane bound organelles.
- Include animal, plant, fungi, algae cells as well as other microscopic eukaryotes.
- Evolved from prokaryotic cells.

Phylogenetic Tree of Life



Eukaryotic Genomes

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

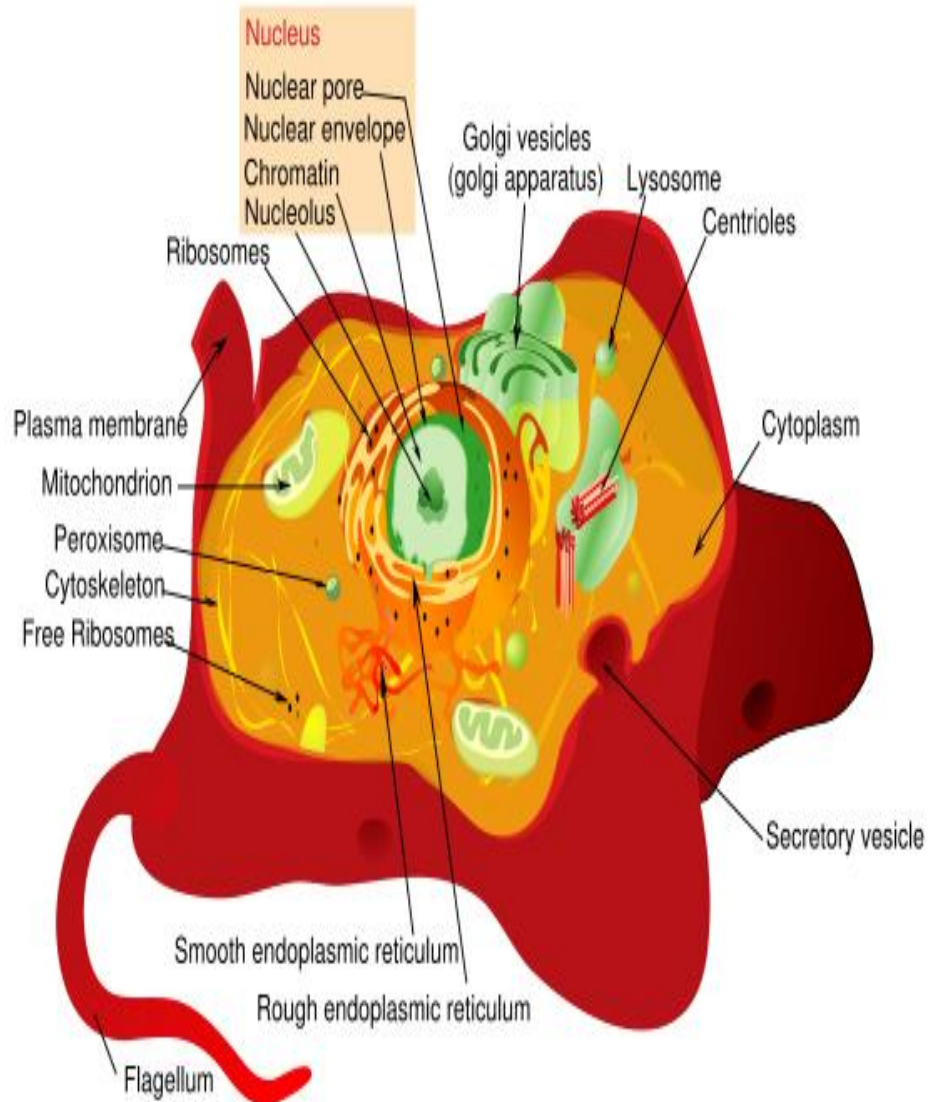


Cytoplasm

Nicknames: The Matrix,
Molecular Chowder

- Fills the space between the plasma membrane and the nuclear membrane
- A water-like substance that fills cells.
- Consists of **cytosol** and **cellular organelles** except for the cell nucleus.
- **cytosol** is made up of water, salts, organic molecules and many enzymes that catalyze reactions.

Q: Eukaryotes? Prokaryotes? Both?

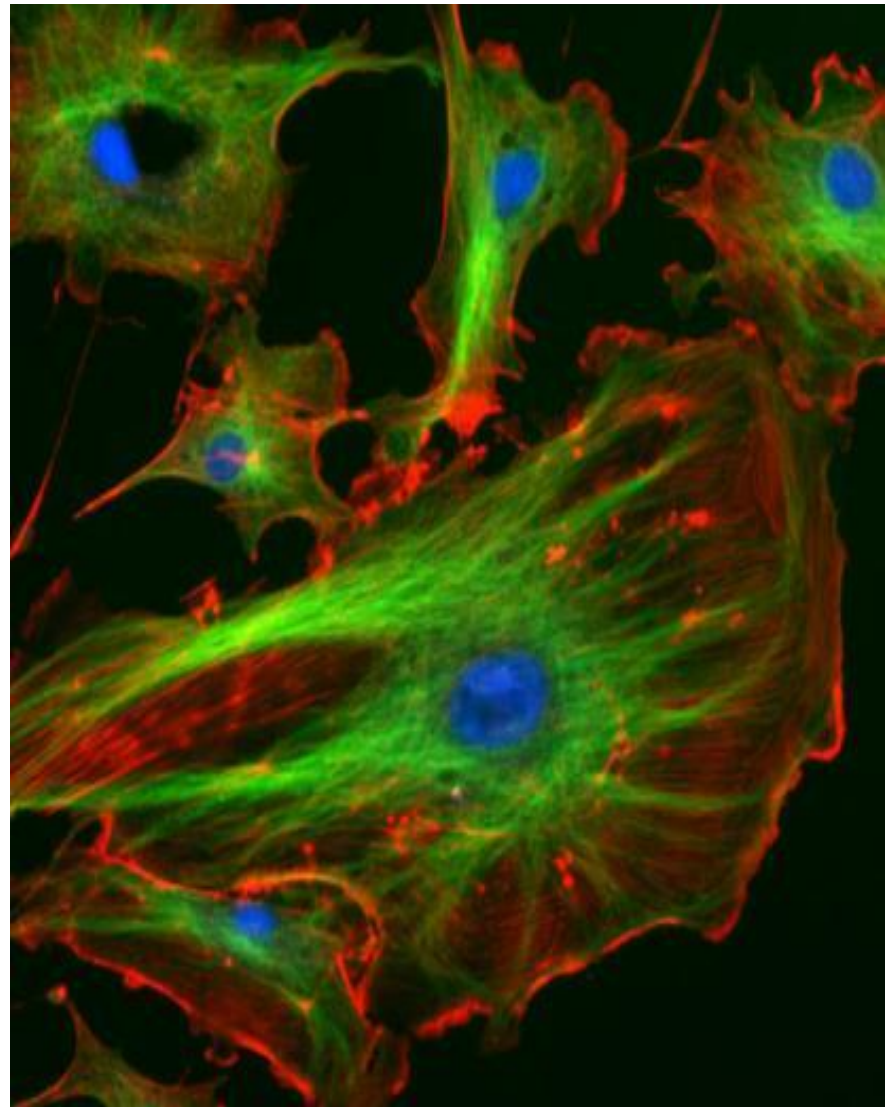


Cytoskeleton

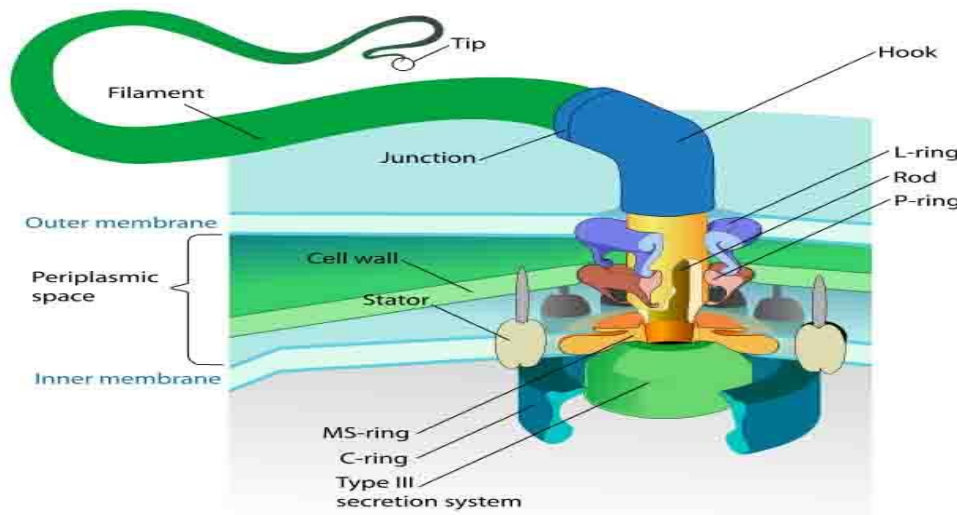
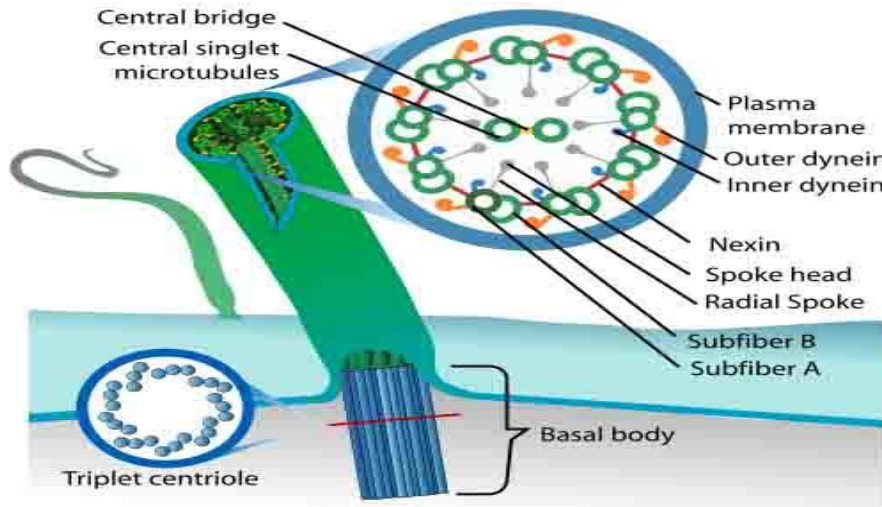
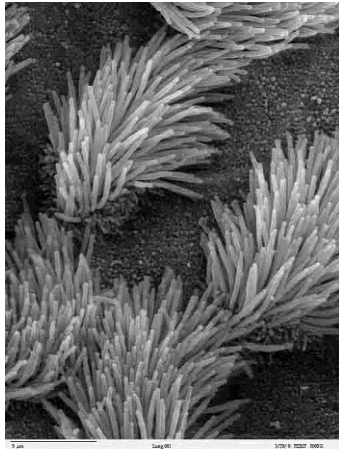
Nicknames: Scaffolding,
Highways

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

Q: Eukaryotes? Prokaryotes? Both?



Cilia & Flagella



- 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, **fimbriae** or pili (composed of proteinaceous molecules and not covered with plasma membrane).

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. Microfilaments

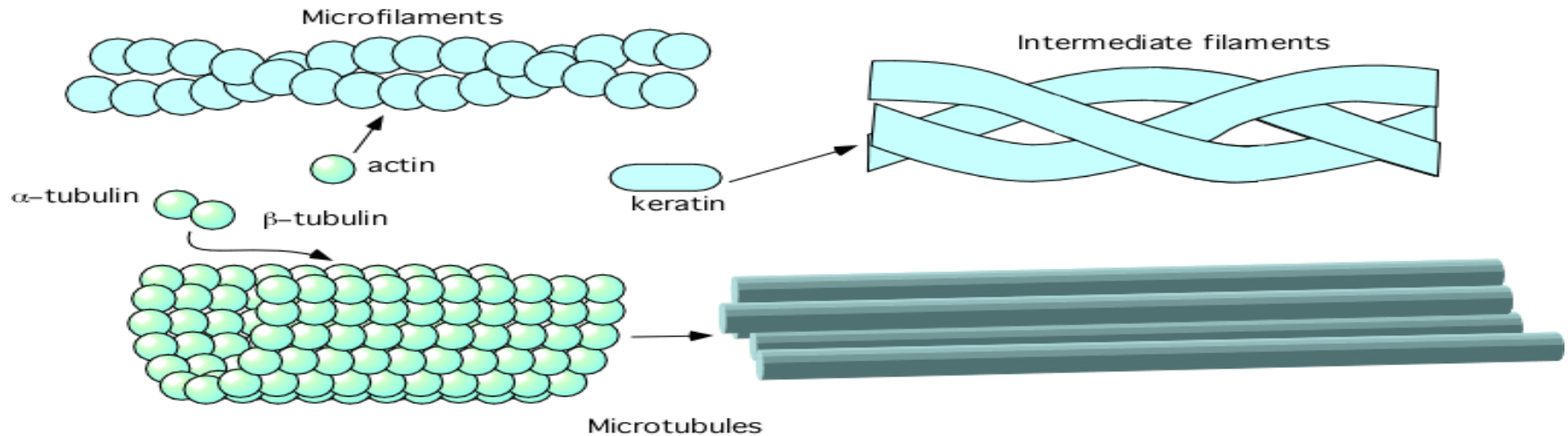
Two intertwined strands of actin protein.

2. Intermediate Filaments

Fibrous proteins supercoiled into thick cables.

3. Microtubules

- 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**.

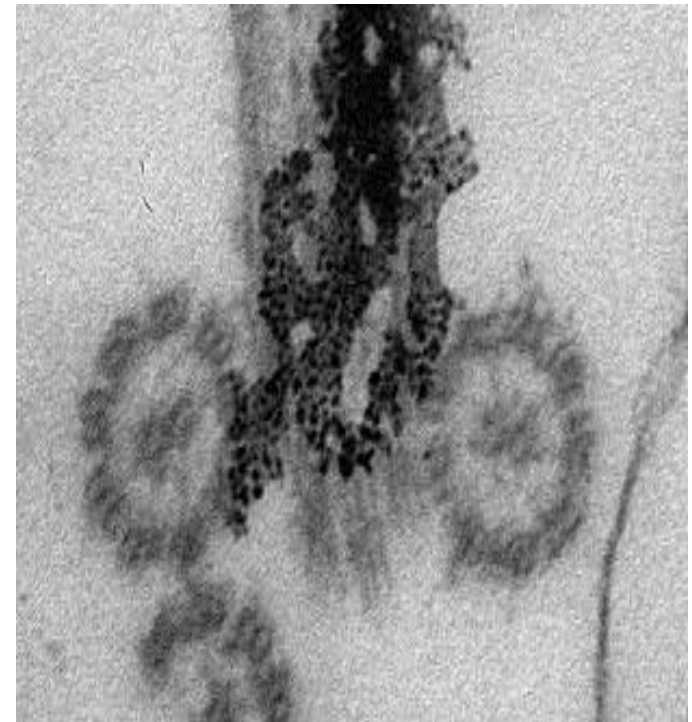
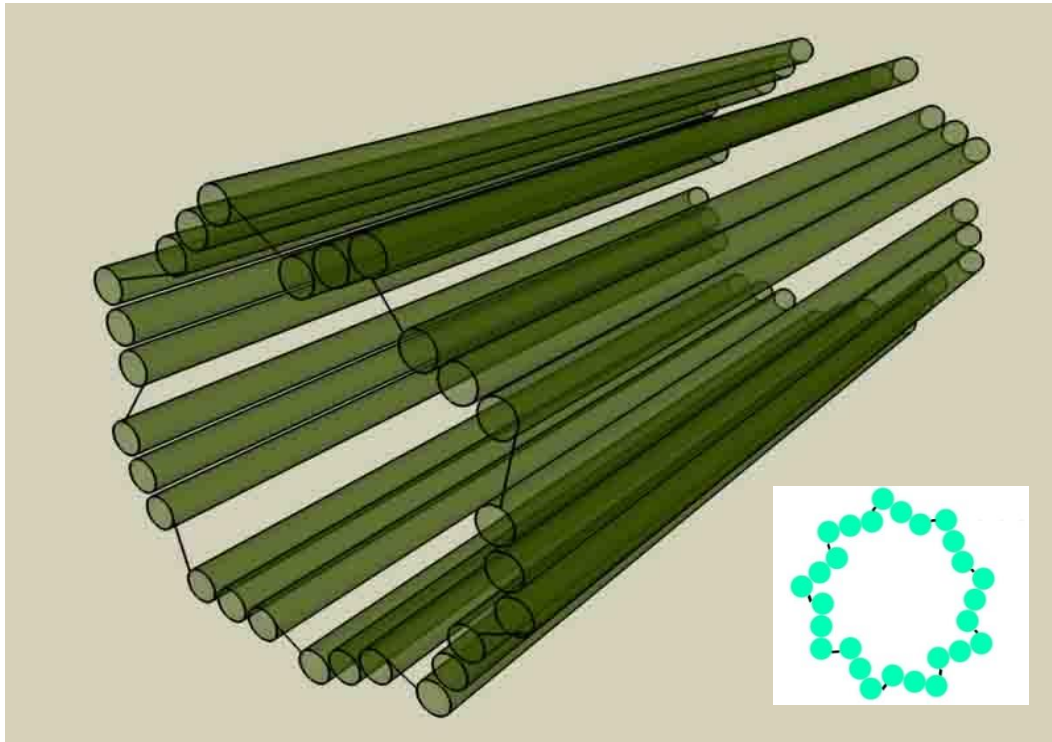


CYTOSKELETON: Centrioles & Centrosomes

The **centrosome**, also called the "microtubule organizing center", is an area in the cell where microtubules are produced.

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

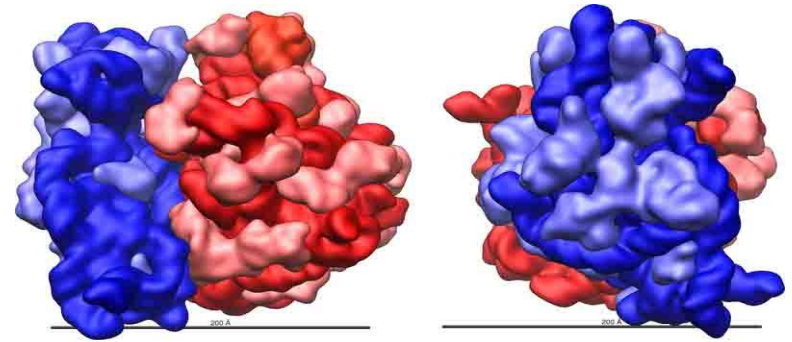
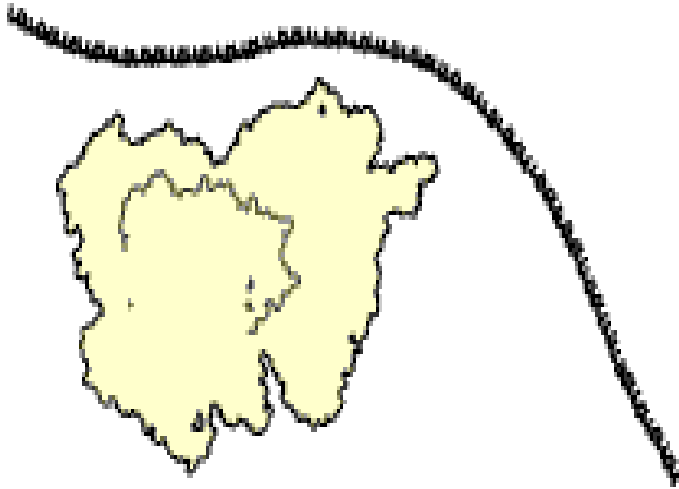
Microtubules > Centriole > Centrosome



Images: [Centriole Cross-section](#) & [Centriole-3D](#),
Twooars; [Micrograph of Centrioles](#), Christos Chinopoulos

Ribosomes

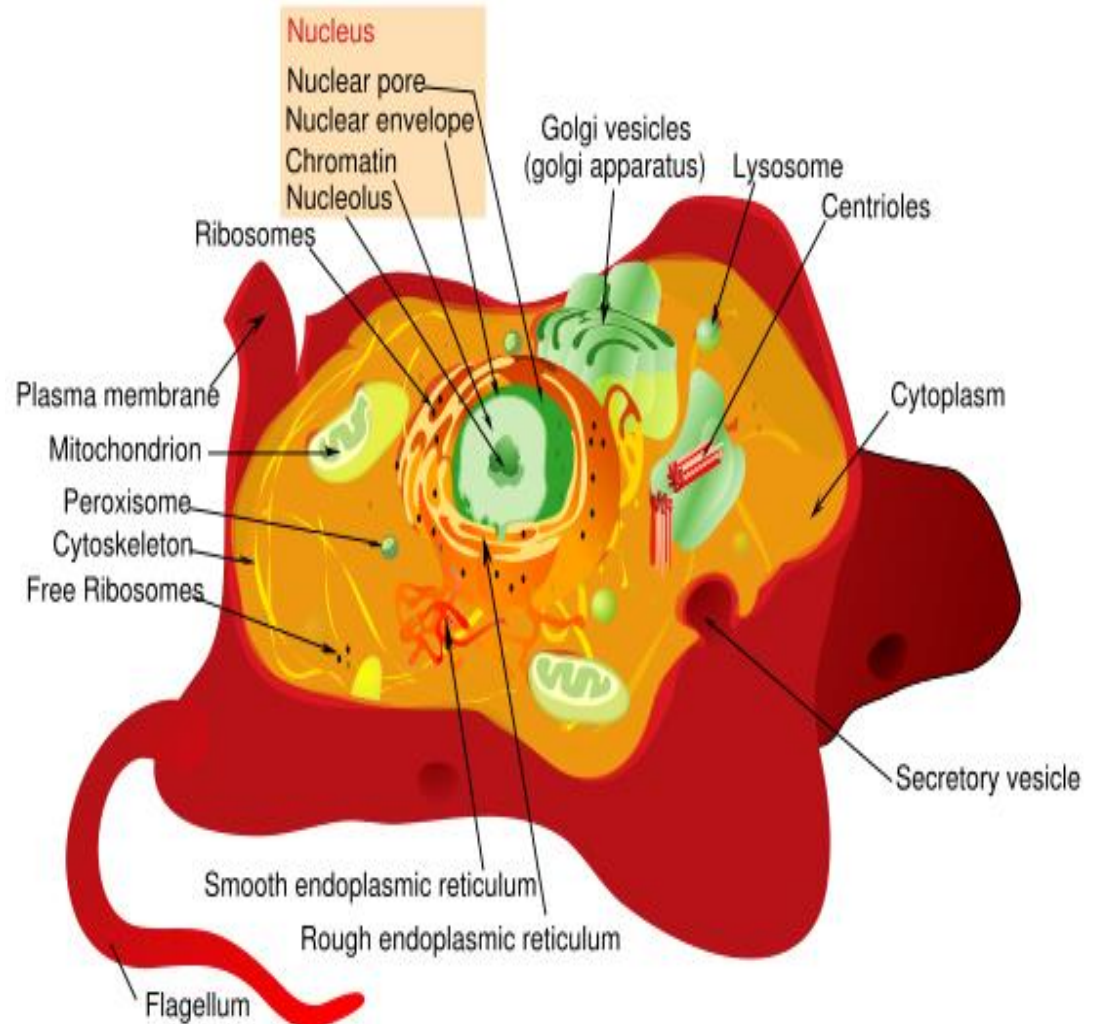
[Click here](#) for animation of ribosome building a protein.



- **Q:** What do ribosomes 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?

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.



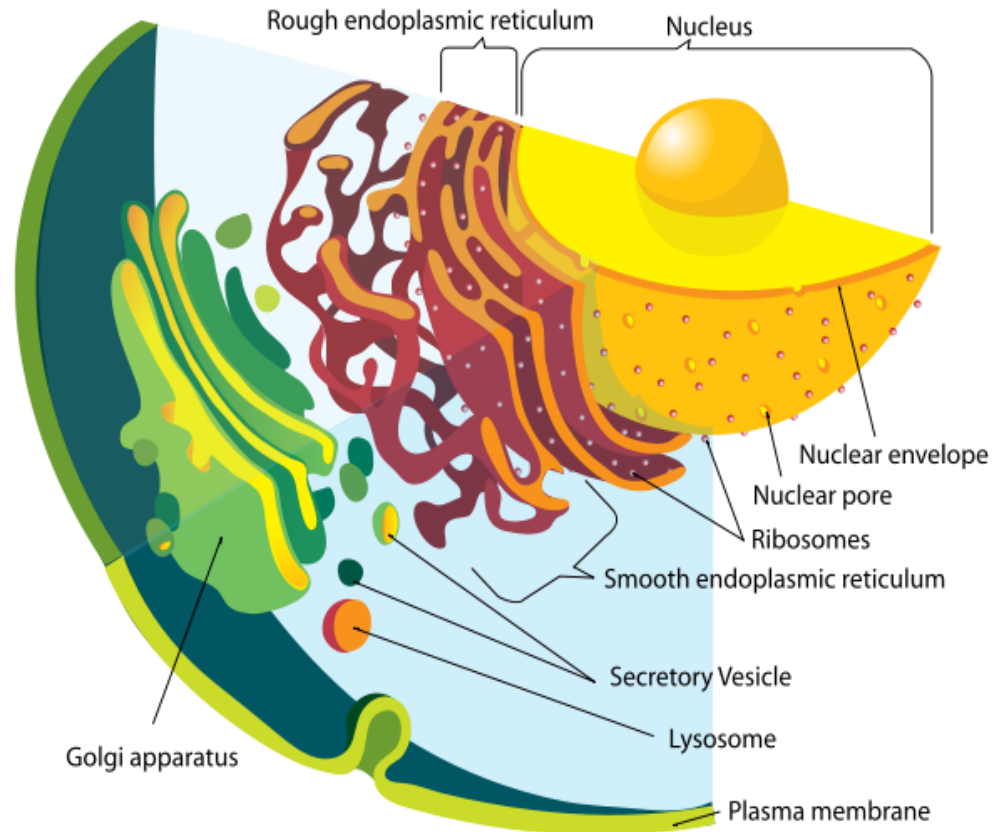
System of internal membranes within eukaryotic cells that divide the cell into compartments, or organelles.

Transport system, for moving molecules, into, out of, and 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:

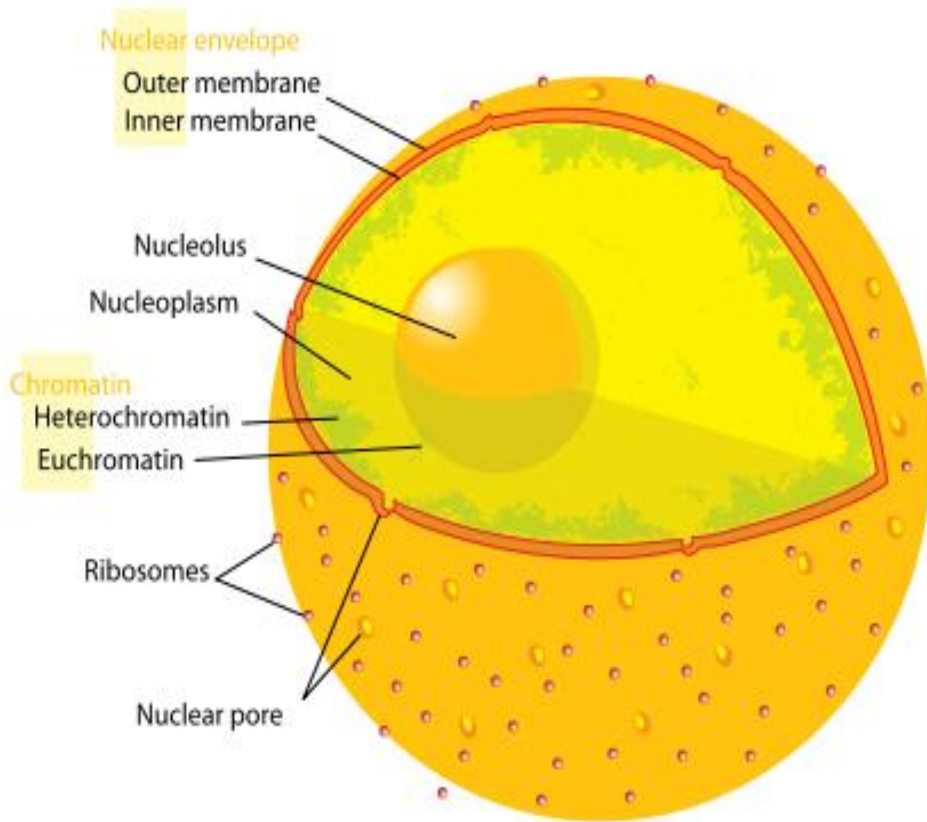
1. nucleus
2. endoplasmic reticulum
3. Golgi apparatus
4. vesicles
5. lysosomes
- 6... **Q:** What other membranous part of the cell should also be included in this list?





ENDOMEMBRANE SYSTEM ORGANELLES:

Nucleus



Nickname: Control Center

- Separates the genetic material ([DNA](#)) from the rest of the cell.
- DNA, the genetic material, is a blueprint, or code for making [proteins](#).
- **nuclear membrane** is the double membrane structure that separates nucleus from cytoplasm.

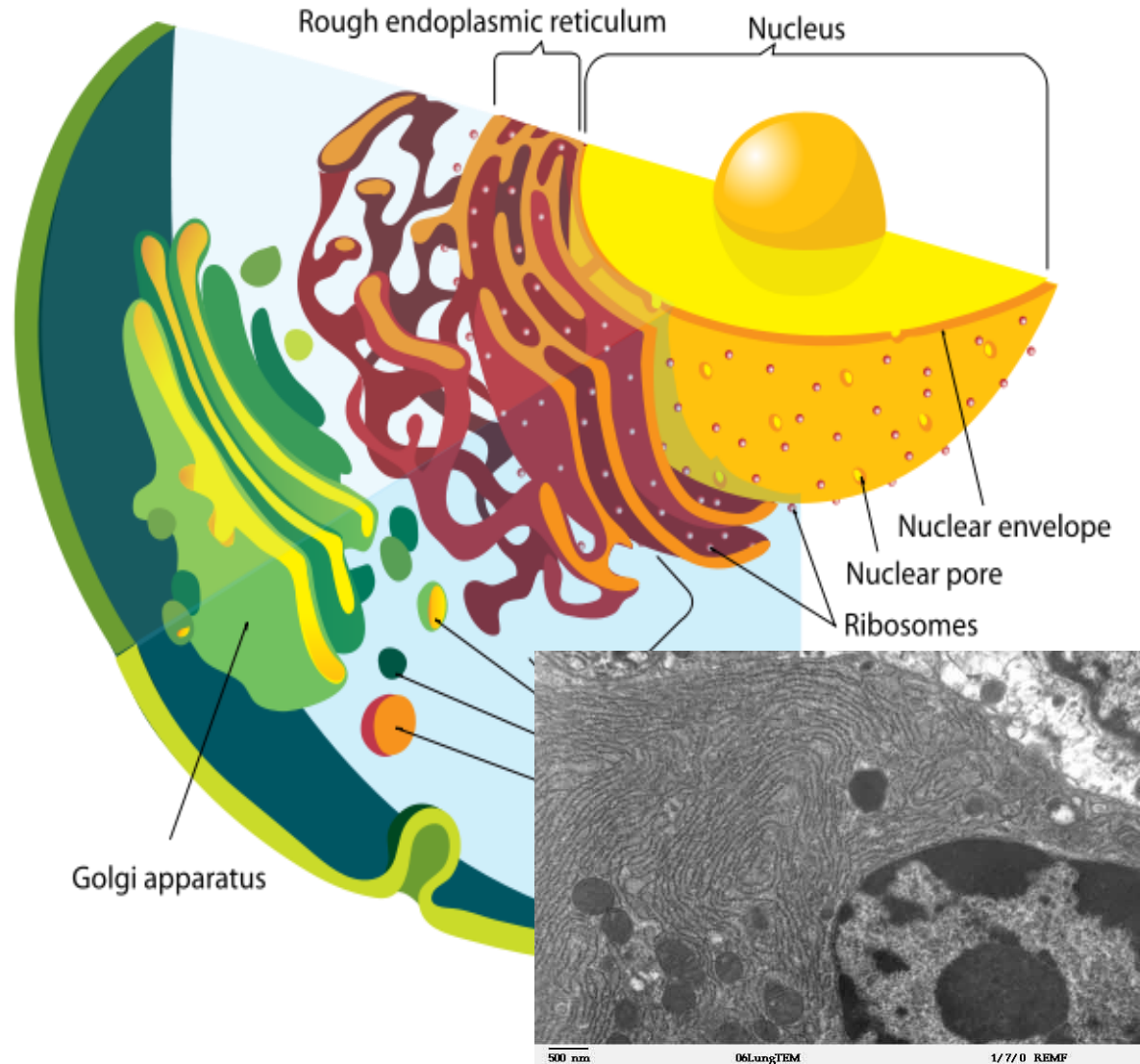
ENDOMEMBRANE SYSTEM ORGANELLES:

Endoplasmic Reticulum

Nickname:

Production Factory
(makes proteins and lipids)

- System of membranous channels and vesicles.
- Internal production & delivery system of the cell.
- **Rough ER** is studded with ribosomes. Site of protein synthesis and processing.
- **Smooth ER** lacks ribosomes. Site of synthesis of phospholipids and packaging of proteins into vesicles.



Images: [Endomembrane system](#) diagram, M. Ruiz, [ER photomicrograph](#), Louisa Howard.

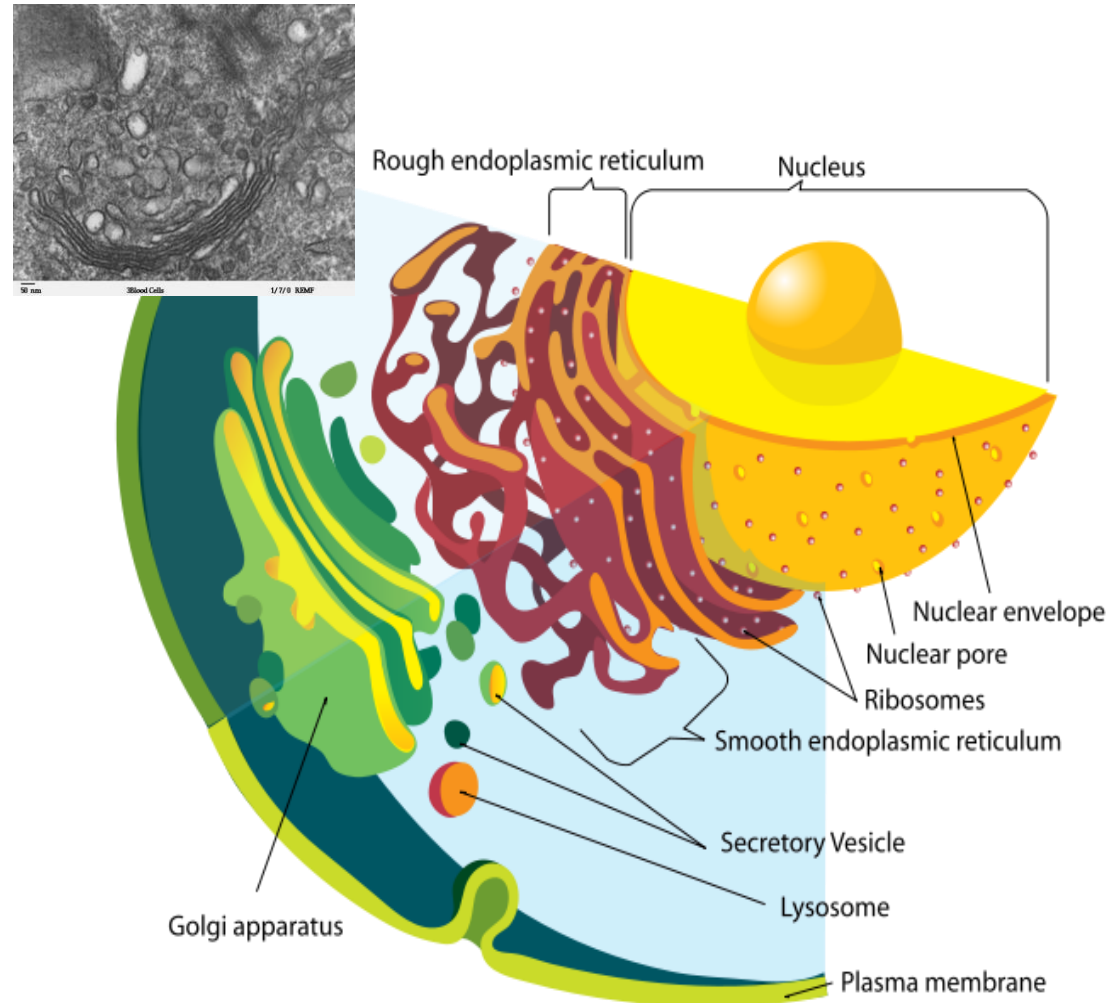
ENDOMEMBRANE SYSTEM ORGANELLES :

Golgi apparatus

Nickname:

Assembly Factory

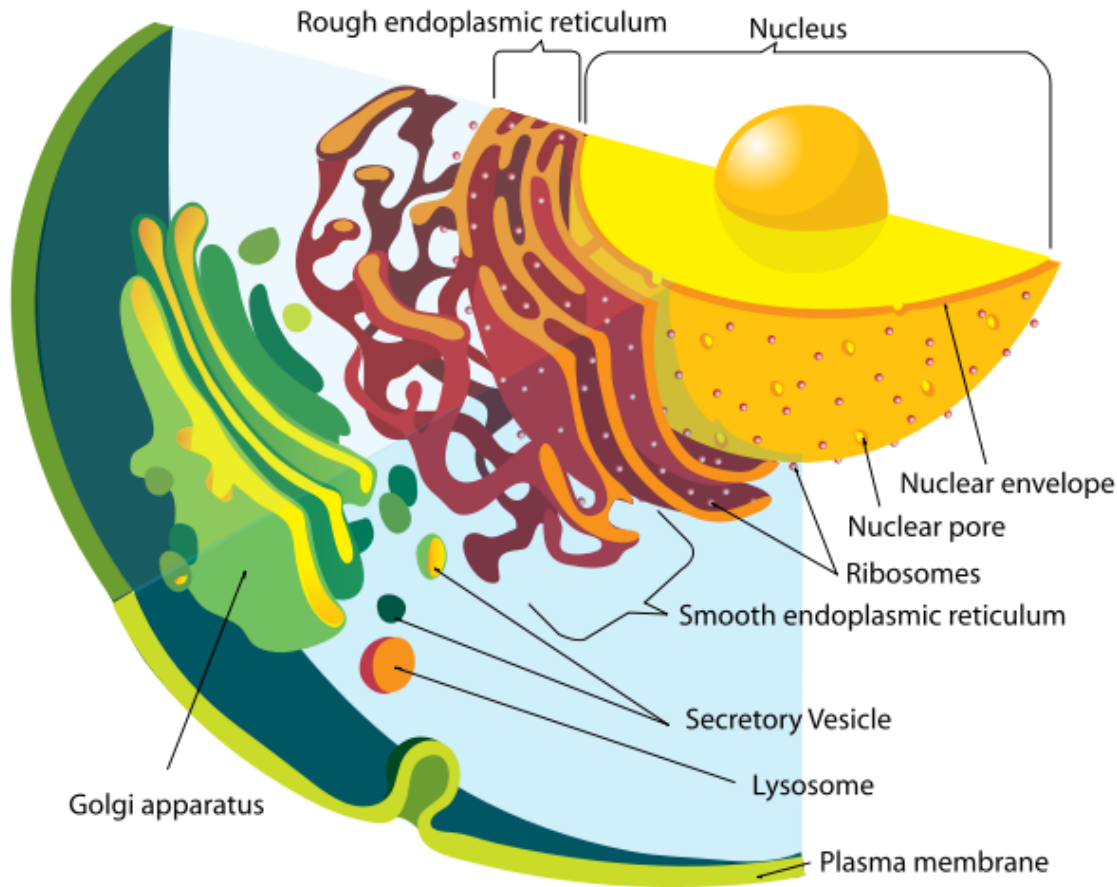
- Takes simple molecules and puts them together into more complex macromolecules.
- Packages, modifies, and transports materials to different location inside/outside of the cell.
- Consists of a stack of curved saccules.
- Receives [protein](#) and also [lipid](#)-filled vesicles from the ER, packages, 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:

Vesicles



Nickname: The Trucks

- 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 (**endocytosis**) or discharging (**exocytosis**) materials.
- **REVIEW:** Animation on [endocytosis & exocytosis](#)



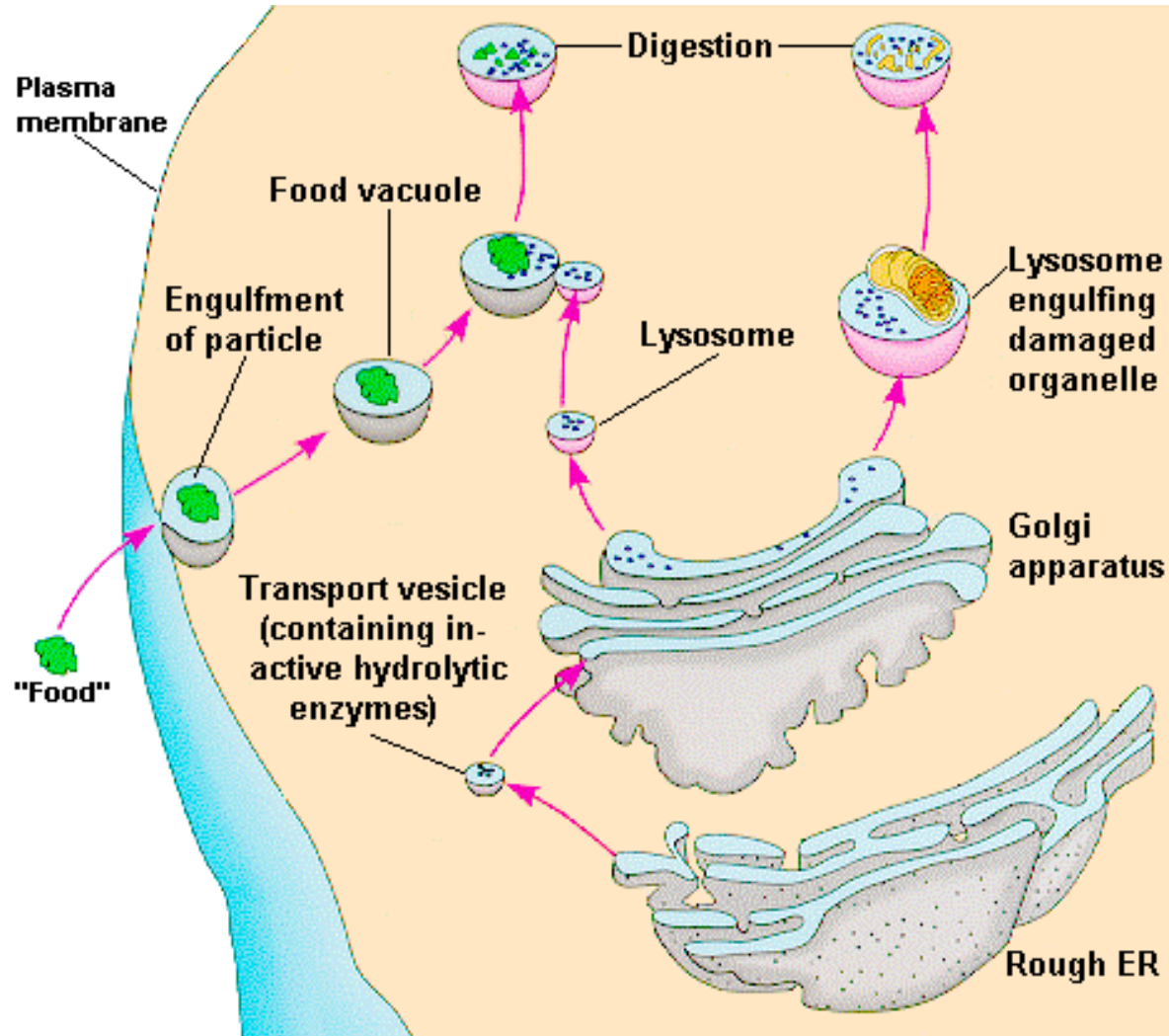
ENDOMEMBRANE SYSTEM ORGANELLES:

Lysosomes

Nickname:

Recycling Trucks

- Break down food into particles and also destroy old cellular components.
- **Q:** Which organelle produces lysosomes?
- Contain hydrolytic enzymes and are involved in intracellular digestion.



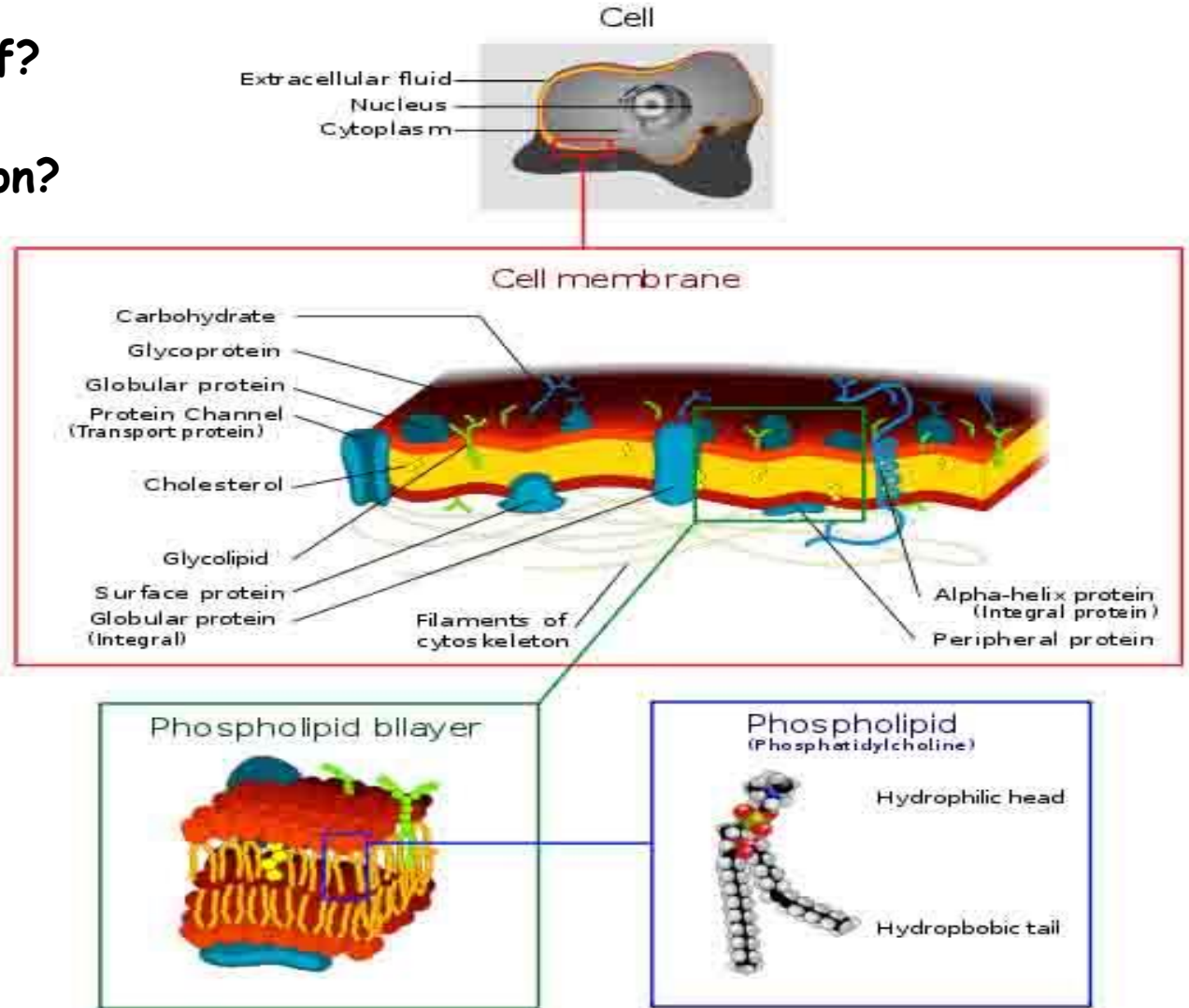


ENDOMEMBRANE SYSTEM ORGANELLES:

Plasma Membrane

Q: What is it made of?

Q: What is its function?



REVIEW!

Animation and
quiz on the
eukaryotic
Endomembrane
System.

We hope that you
enjoyed your trip
through the
endomembrane
system!

Have a
nice day!

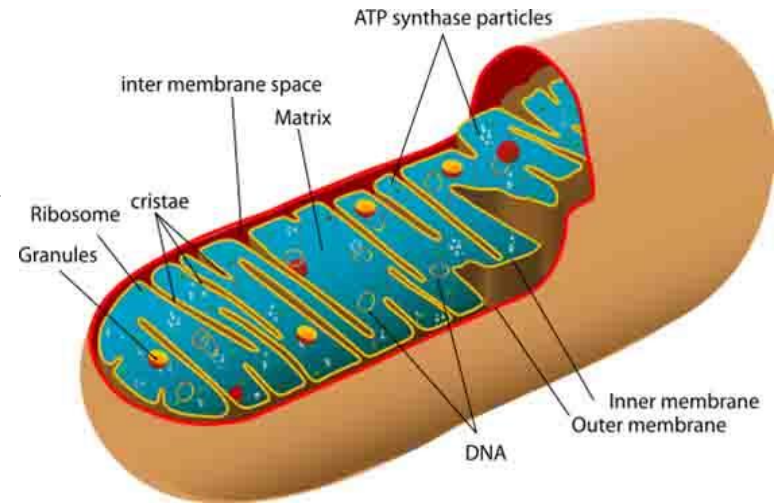


Organelles: Energy-Related

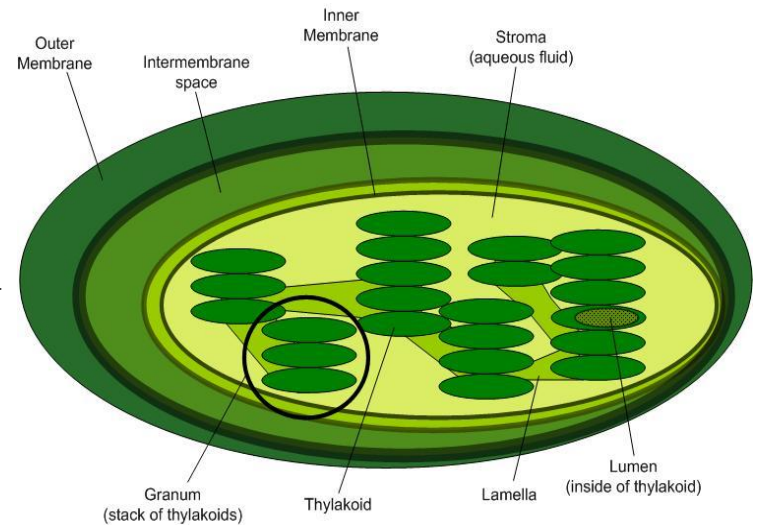
Mitochondria & Chloroplast

- Both organelles house energy in the form of ATP.
- Both ancestrally were independent cells that formed a symbiotic relationship with other cells.
- **Q: Eukaryotes?
Prokaryotes? Both?**

*Found in
nearly all
eukaryotes* →

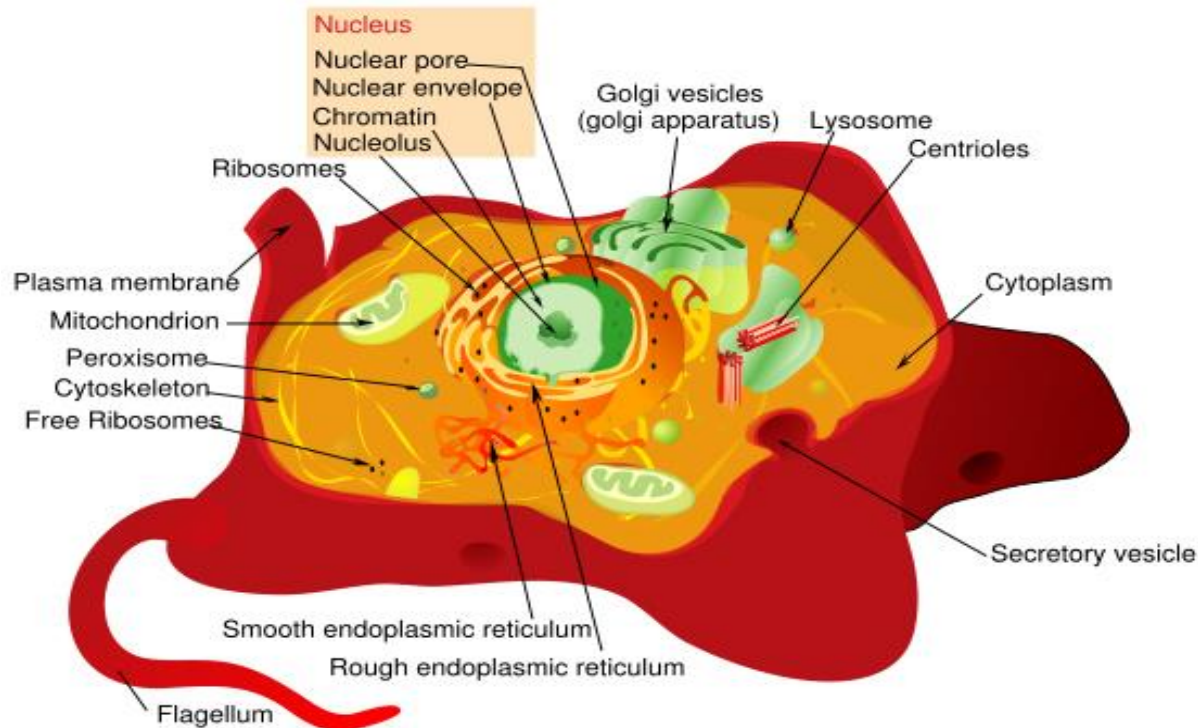


*Found in
plants &
algae &
some
microbes* →



REVIEW!

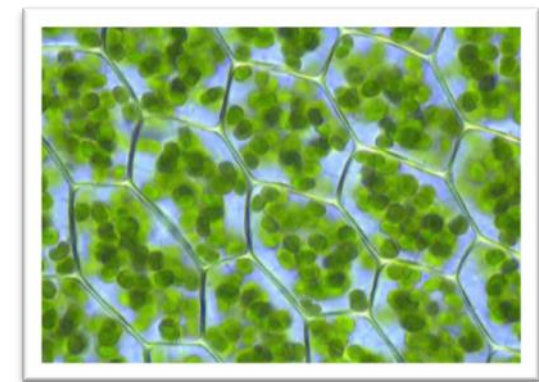
Here's an excellent interactive lesson on [Eukaryotic Cell Structure](#).



Now let's
learn about
additional
structures
found in
Plant Cells



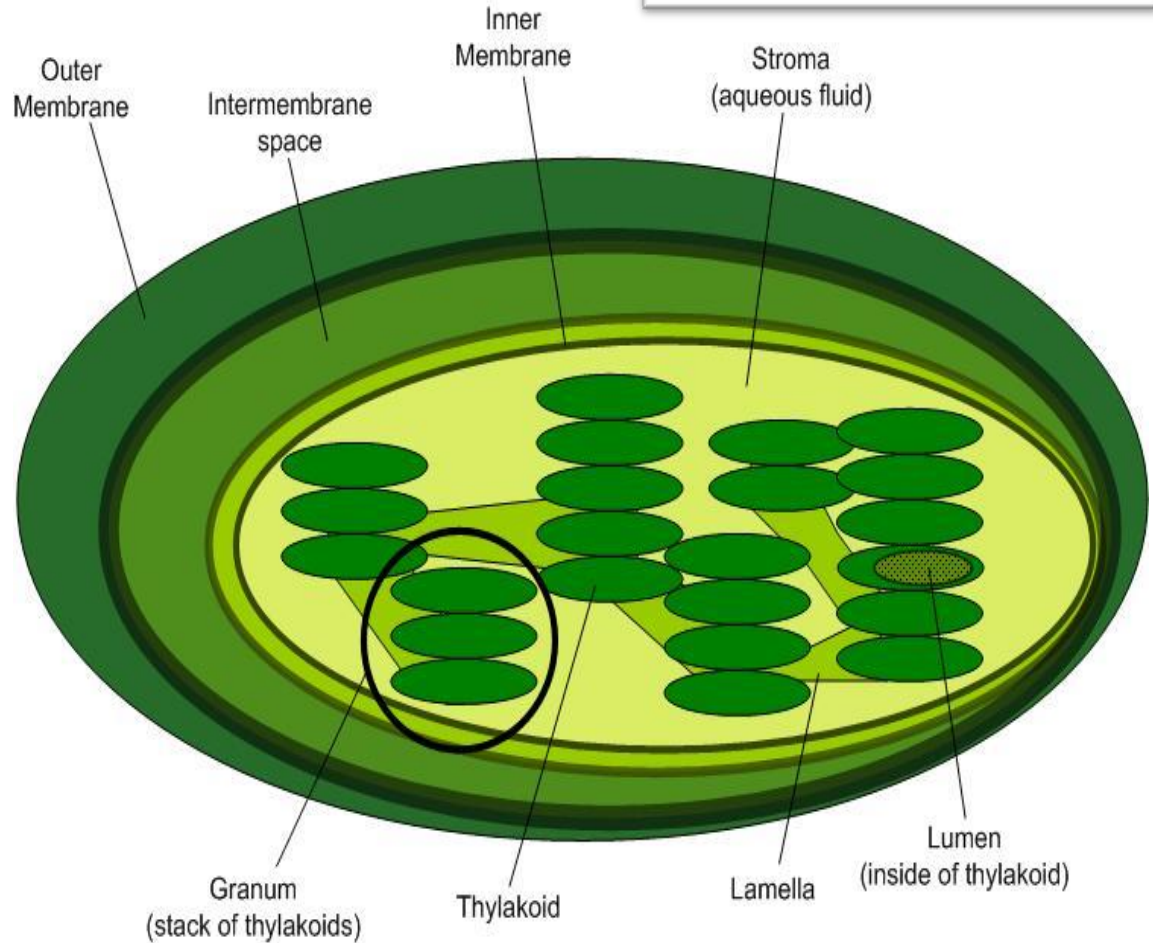
ENERGY-RELATED ORGANELLES: Chloroplasts



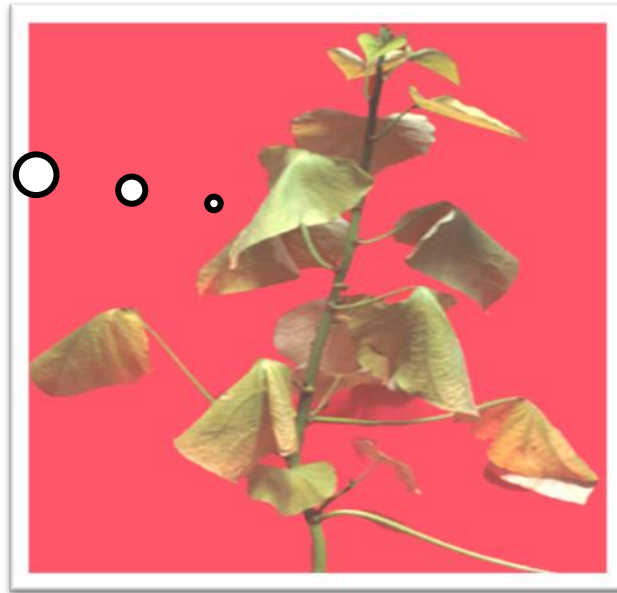
Nickname:
Solar Panels

Captures sunlight energy to make [ATP](#).

chlorophyll (a green pigment) absorbs solar energy and [carbohydrates](#) are made in the stroma.

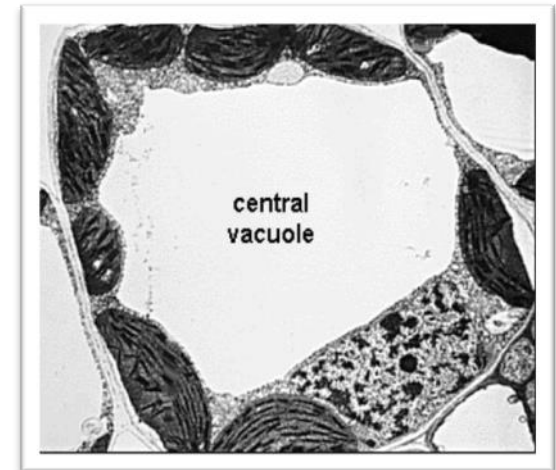
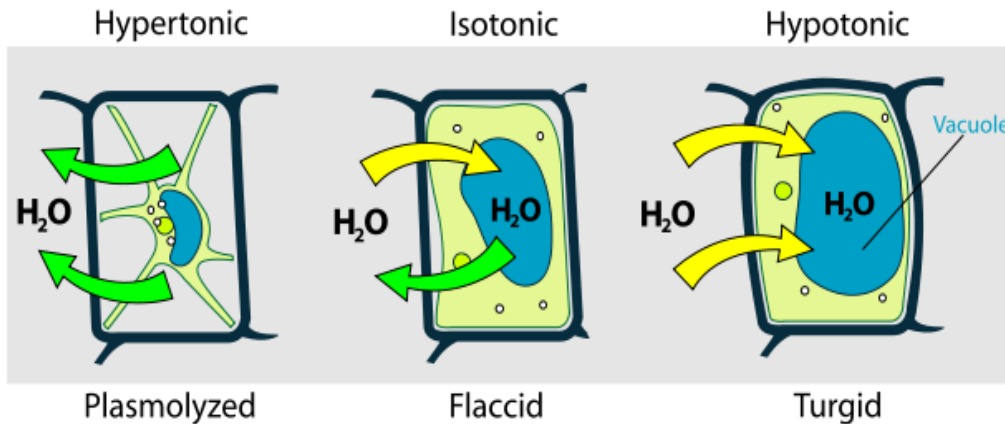


PLANT CELL: Vacuole



Nickname: Reservoir

- Stores water.
- This is what makes lettuce crisp.
- When there is low water, the plant wilts.



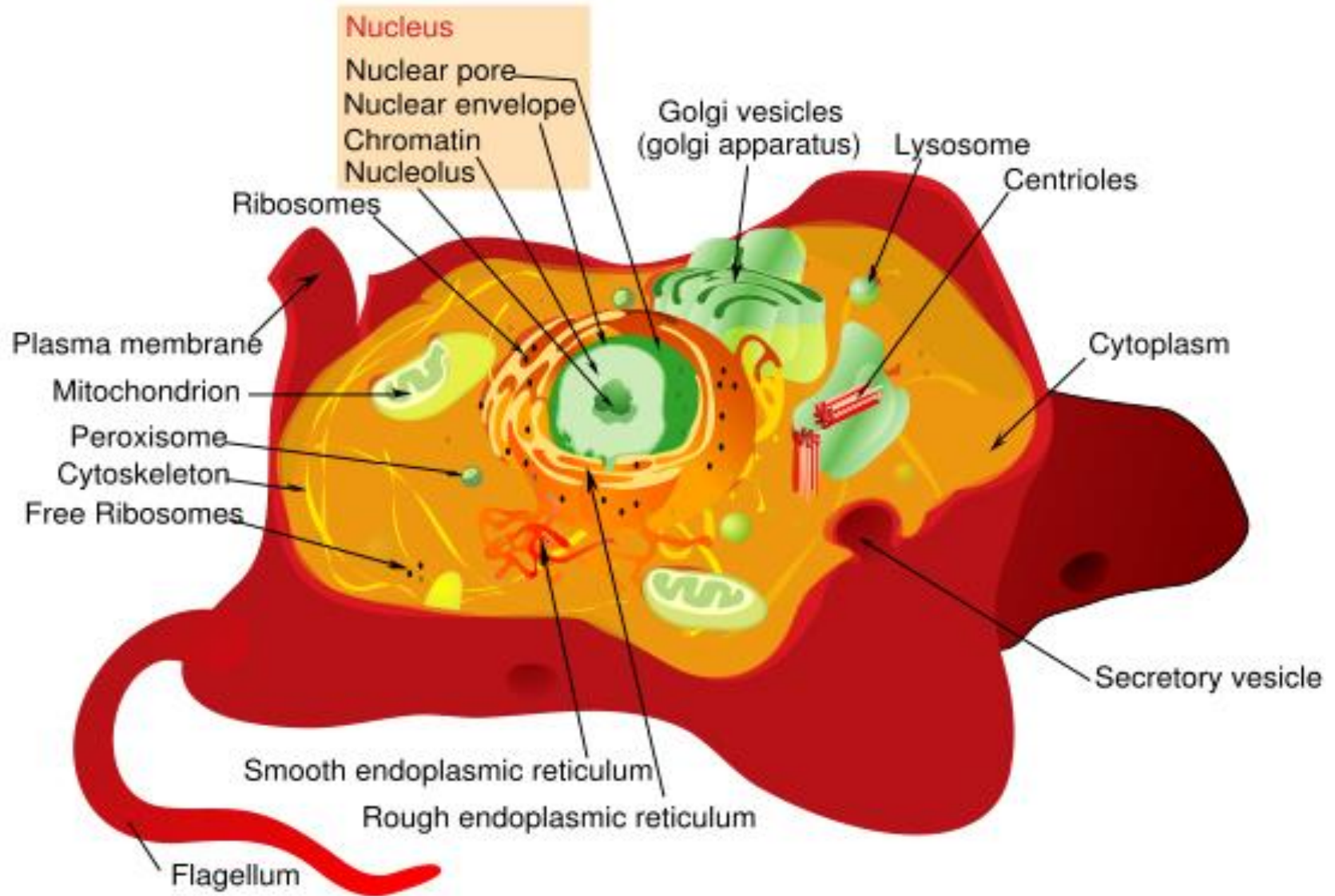
PLANT CELLS: Cell Wall



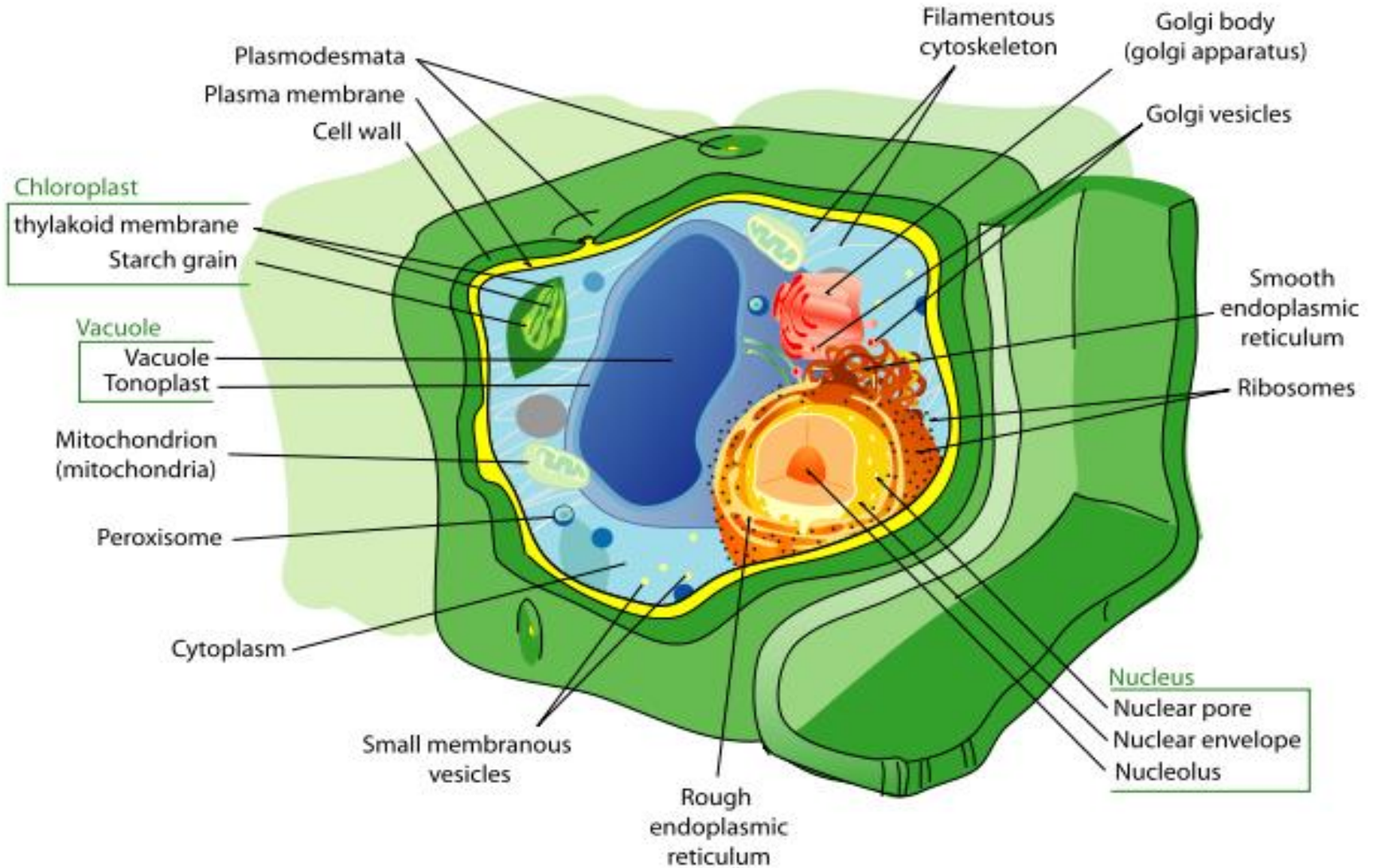
Function: Provides support and protection to the cell membrane

Found outside the cell membrane in plant cells.

Animal Cell (Eukaryote)



Plant Cell (Eukaryote)



Confused?

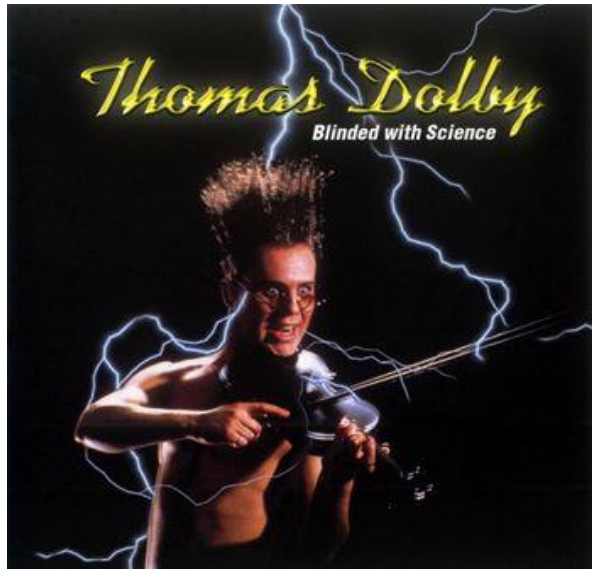
Here are some links to fun resources that further explain Cell Biology:

- [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.)

Smart Links





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