

Cytology

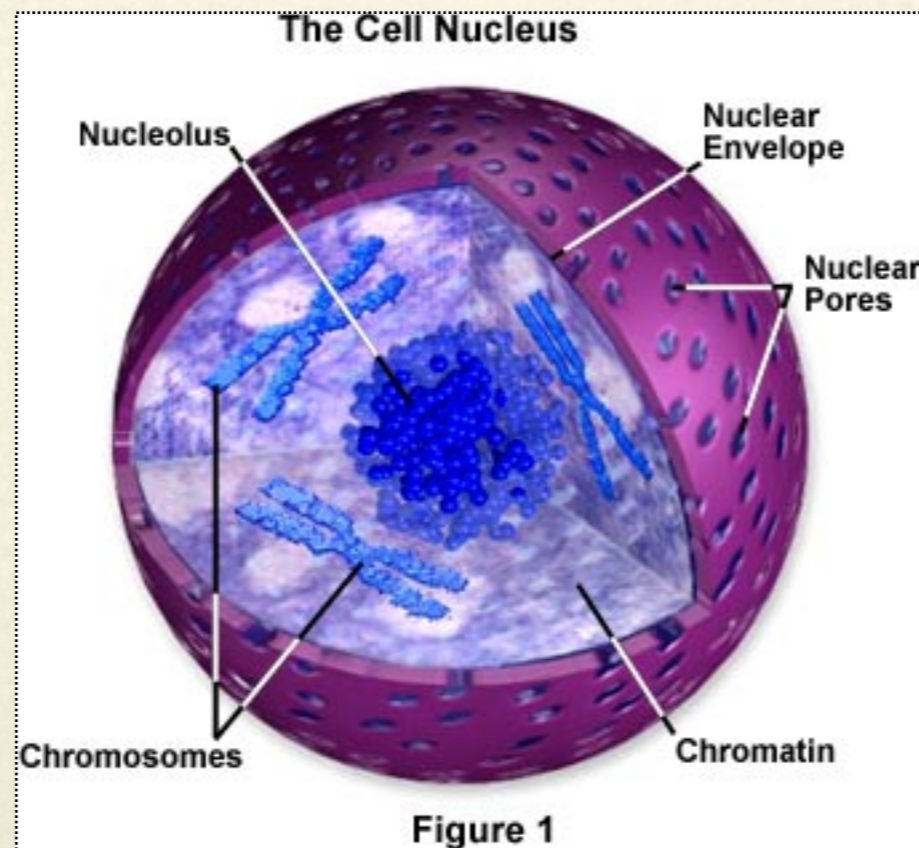


Structures and Functions of Cell Components

The Nucleus

Structure

- ❖ The nucleus is surrounded by the **nuclear envelope**, which consists of **nuclear membranes**.
- ❖ The membranes of the nuclear envelope have **pores** which allow particles to move through them.

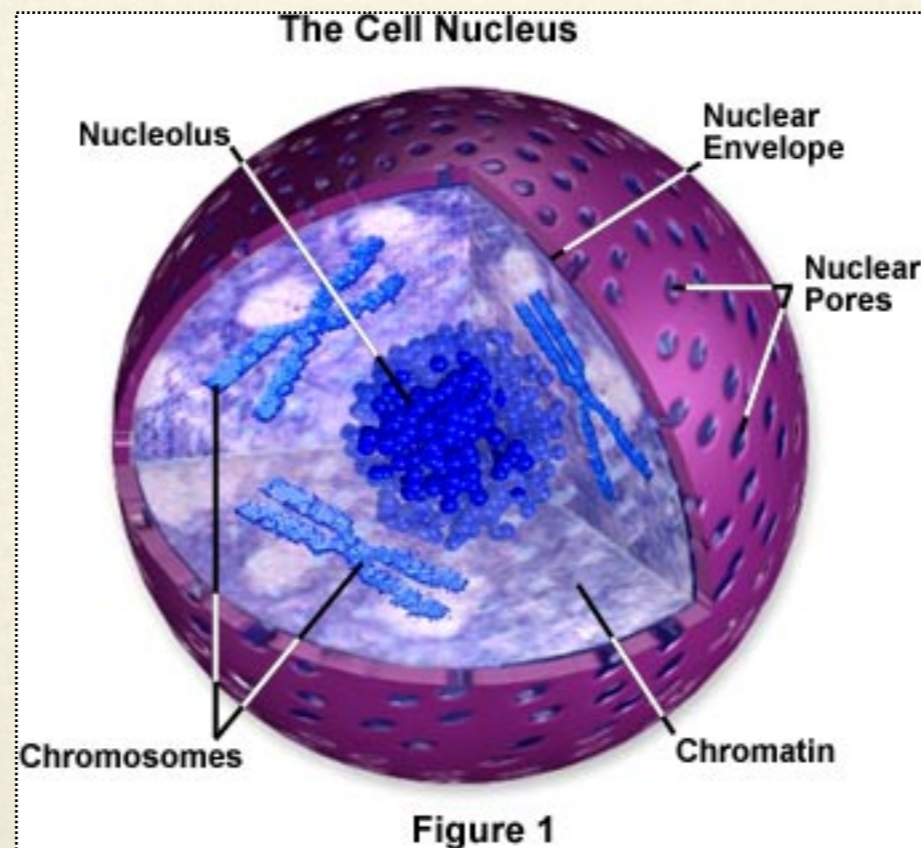


Look at all
that red!

The Nucleus

Structure

- ❖ The nucleus is surrounded by the **nuclear envelope**, which consists of **nuclear membranes**.
- ❖ The membranes of the nuclear envelope have **pores** which allow particles to move through them.





Nucleus

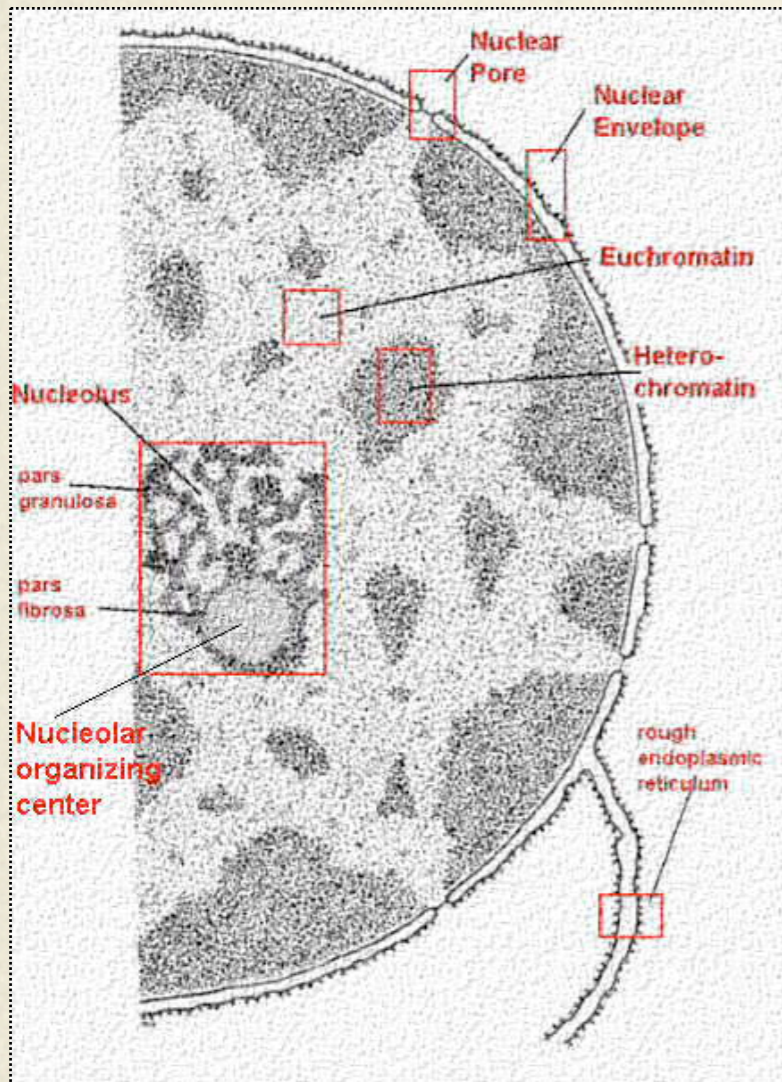
Structure

- ❖ The fluid material inside the nucleus is called the **nucleoplasm**
- ❖ Suspended in the nucleoplasm in a thread like material called chromatin
 - ❖ Chromatin consists of DNA and protein
- ❖ Prior to cell division, the chromatin condenses to form rod like structures called chromosomes

Nucleus

Structure

- ❖ If you look at an electron micrograph of the nucleus there is a dark regions called nucleoli (sing. nucleolus)
- ❖ The nucleolus is where the rRNA is produced





Nucleus

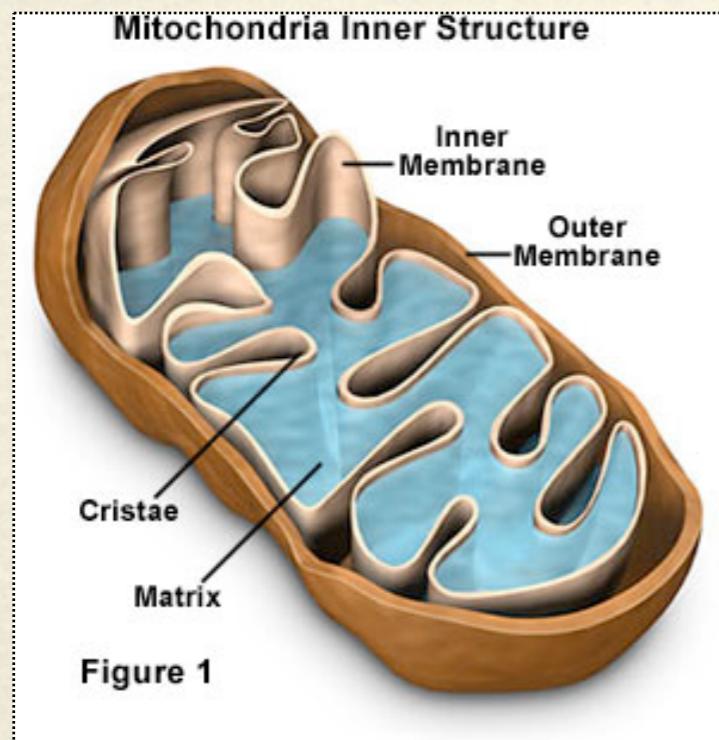
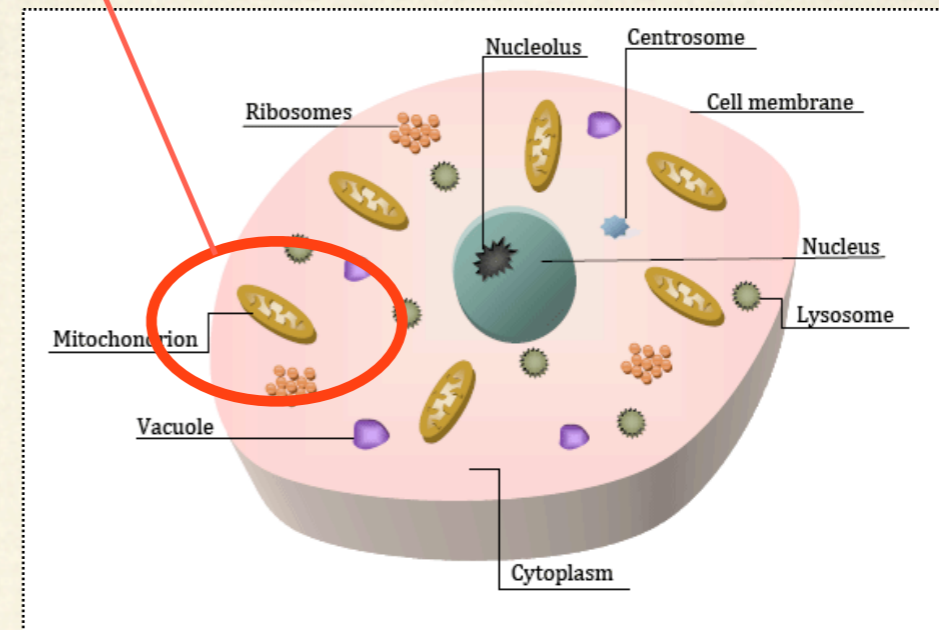
Function

- ❖ The nuclear envelope controls which particles can enter and exit the nucleus through the pores
- ❖ The DNA controls the process of protein synthesis and thus determines the structure and function of proteins
- ❖ Prior to cell division, DNA replication takes place in the nucleus
- ❖ The nucleoli produce rRNA which combine with protein to form ribosomal subunits needed for protein synth.

Mitochondria

Structure

- ❖ Bean shaped organelles surrounded by an inner and outer membrane



- ❖ The inner fluid is called the **matrix**
- ❖ The inner membrane is highly folded to produce projections called **cristae**

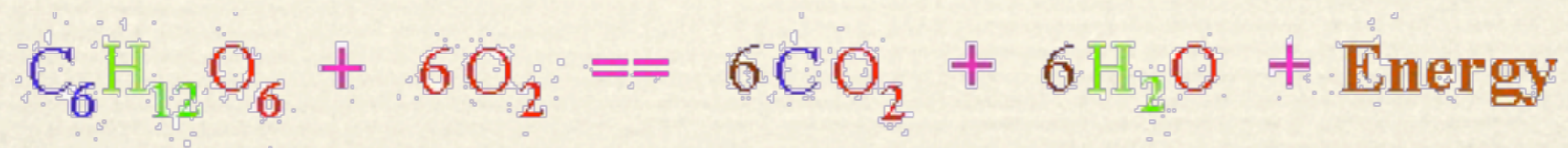
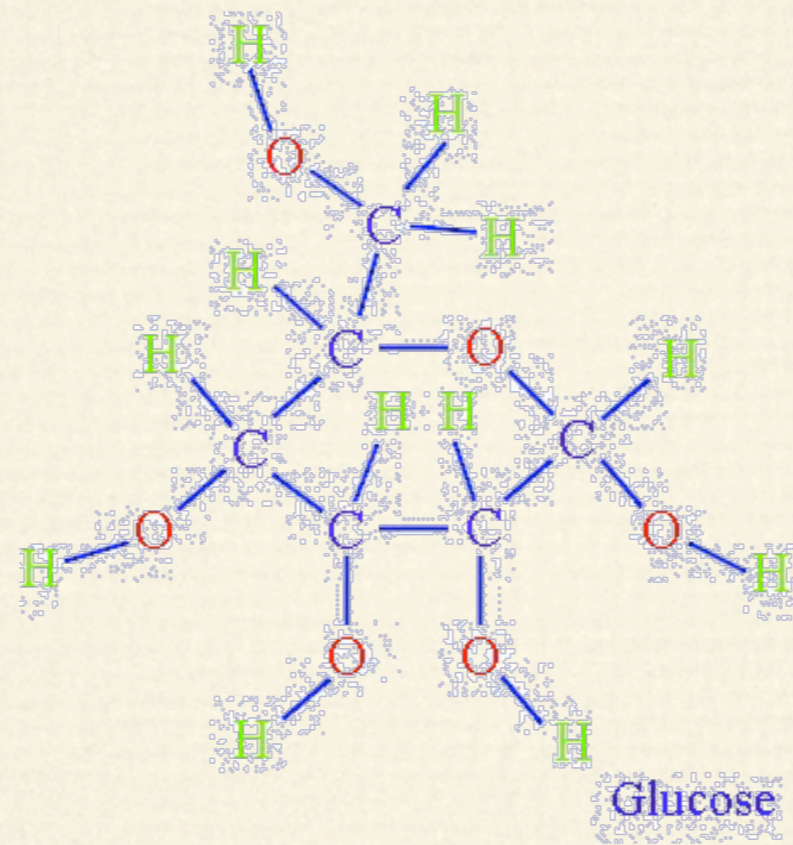


Mitochondria

Function

- ❖ Mitochondria are the site of **aerobic cellular respiration**
- ❖ During cellular respiration, food molecules like glucose are oxidized to release energy
- ❖ This energy is then used to make ATP from ADP and inorganic phosphate
- ❖ The energy in ATP is then used to drive endergonic (energy requiring) metabolic processes of the cell
- ❖ The byproducts of cellular respiration are carbon dioxide

Cellular Respiration Equation



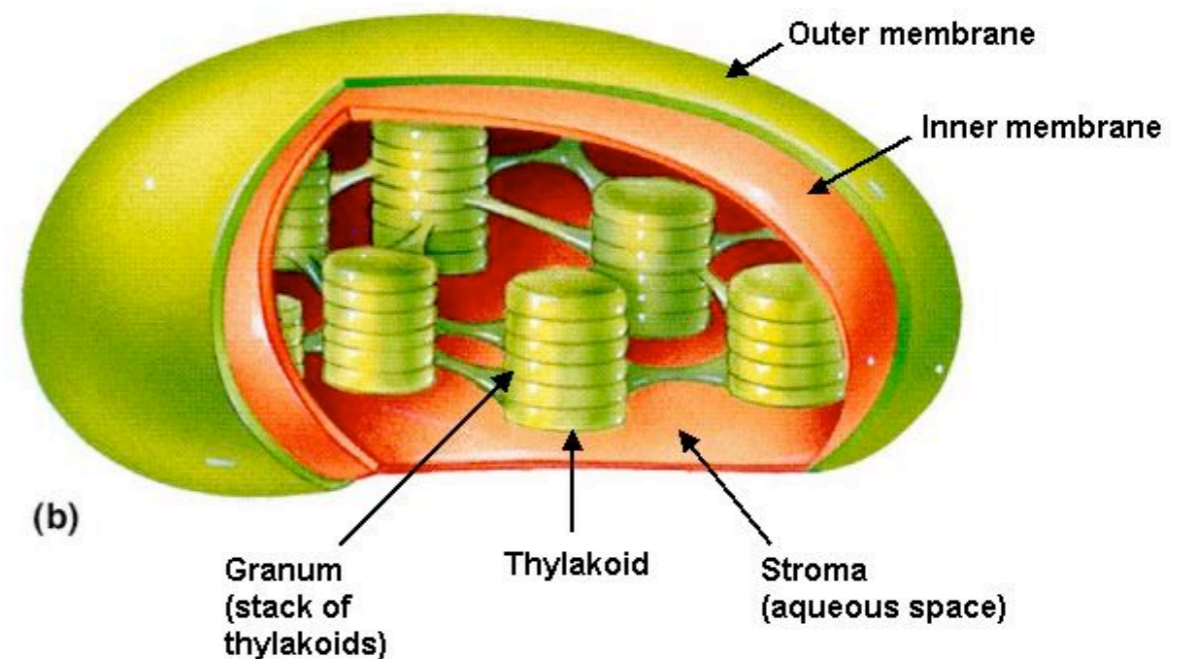
Chloroplasts

Structure

- ❖ Chloroplasts are organelles found in plant cells
- ❖ They have an inner and an outer membrane
- ❖ Between the membranes is the **intermembrane space**
- ❖ The fluid filled space within the inner membrane is called the **stroma**

Randy Moore, Dennis Clark, and Darrell Vodopich, Botany Visual Resource Library © 1998 The McGraw-Hill Companies, Inc. All rights reserved.

Three-dimensional Model of Chloroplast Membranes



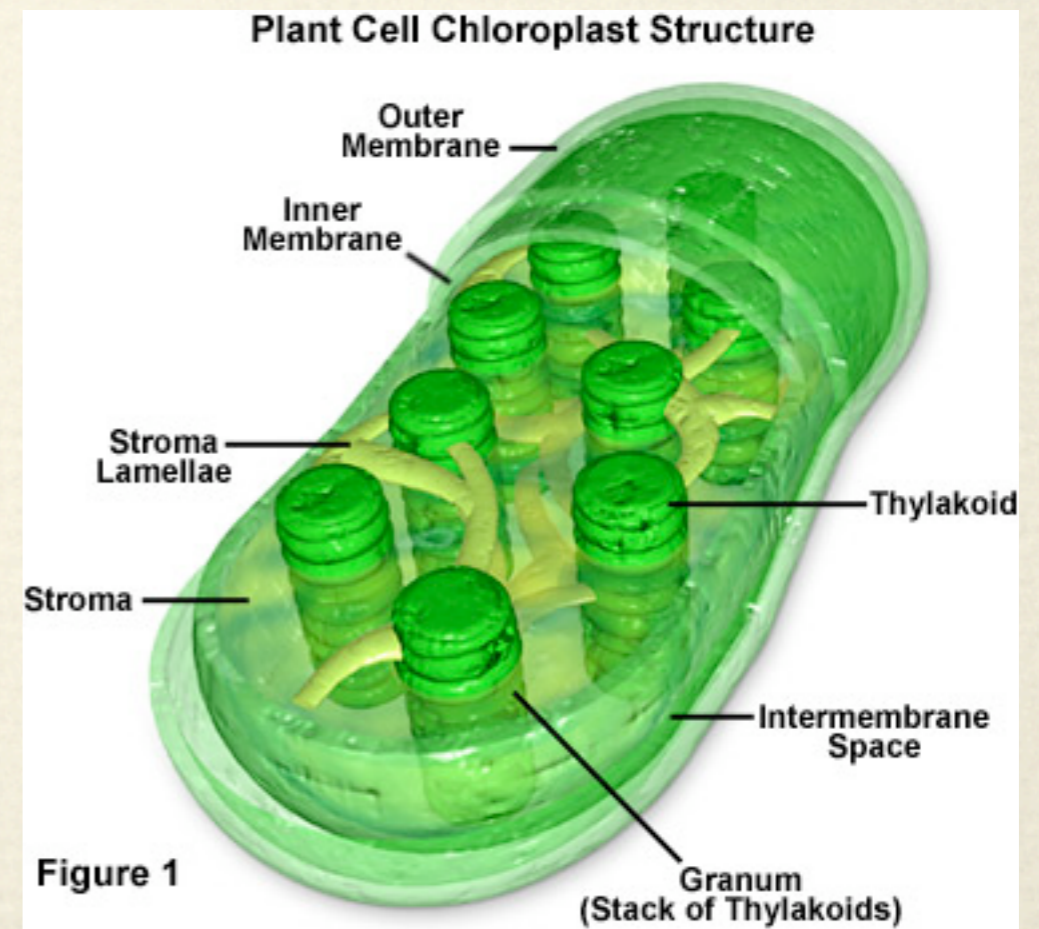
MITOCHONDRIA

❖ PLAY VIDEO

Chloroplasts

Structure

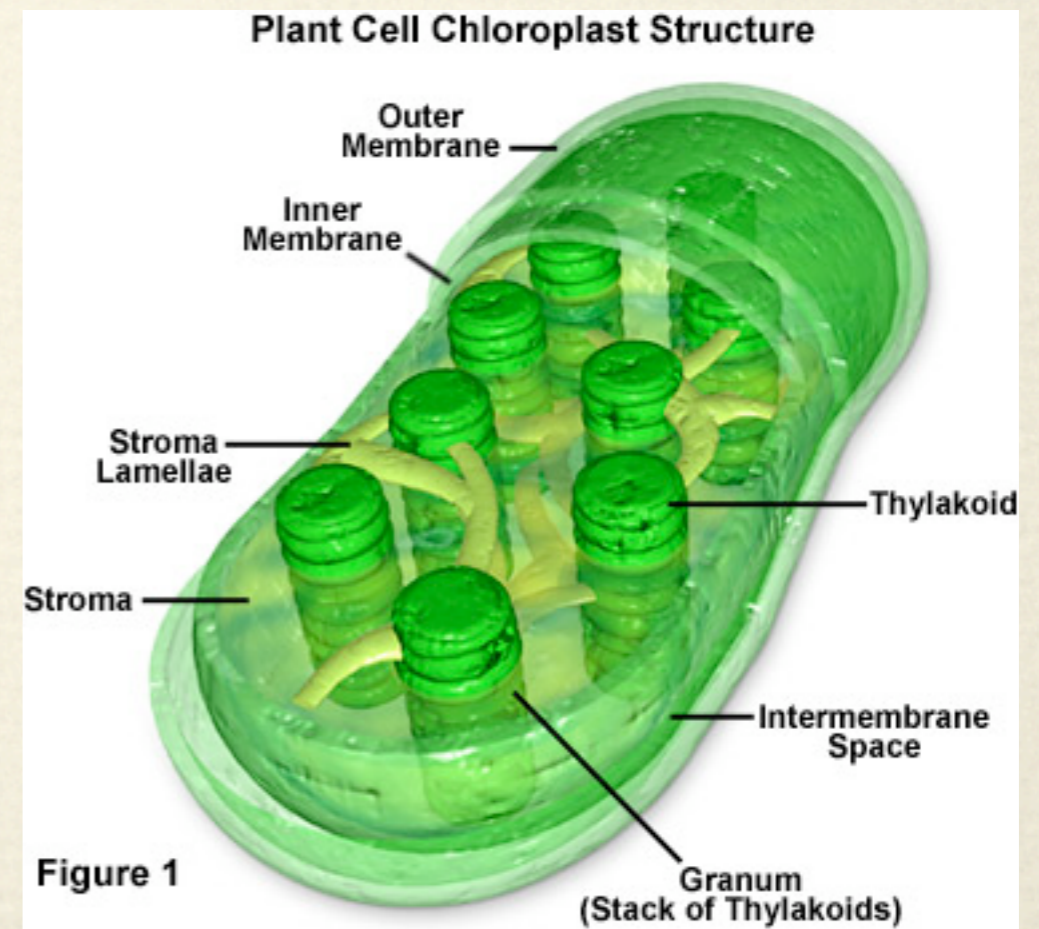
- ❖ Flattened sacs called **thylakoids** are arranged in stacks called **grana** (granum) within the **stroma**



Chloroplasts

Structure

- ❖ Flattened sacs called **thylakoids** are arranged in stacks called **grana** (granum) within the **stroma**
- ❖ The photosynthetic pigment **chlorophyll** is embedded in the membranes of the thylakoid sacs



Chloroplasts

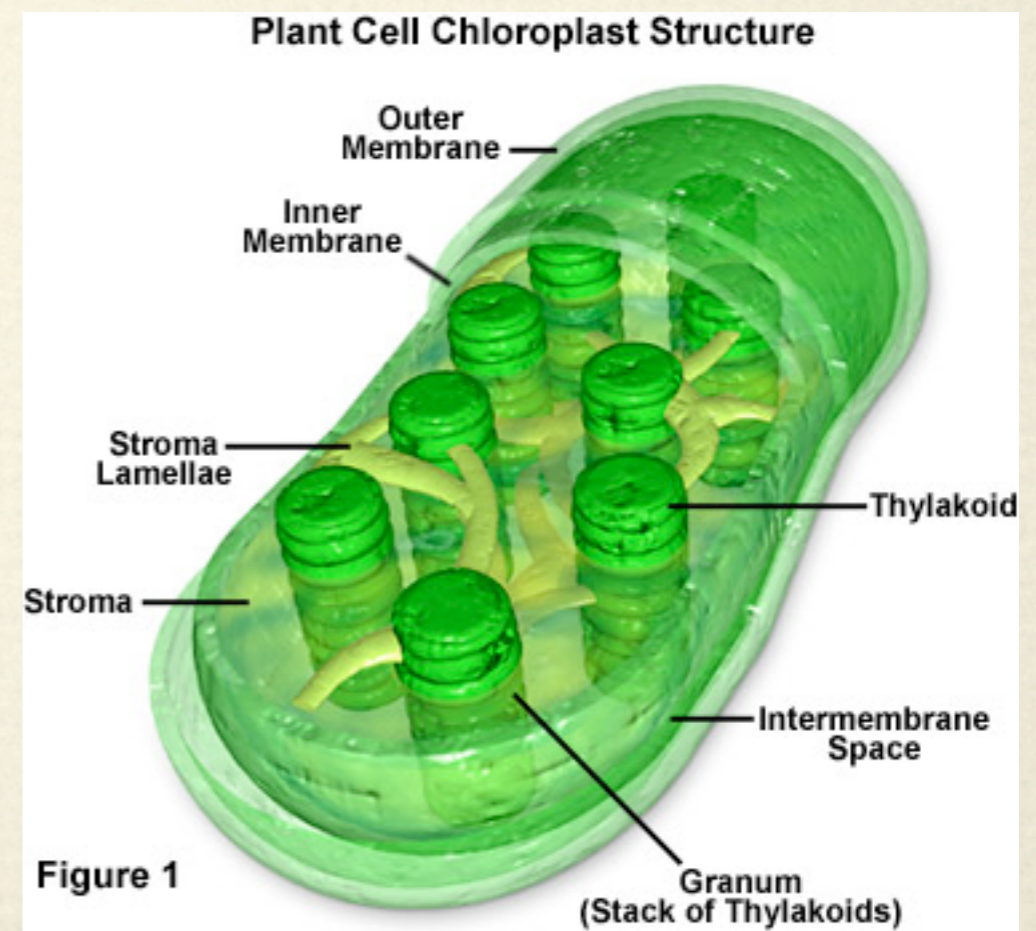
Structure

- ❖ Flattened sacs called **thylakoids** are arranged in stacks called **grana** (granum) within the **stroma**
- ❖ The photosynthetic pigment **chlorophyll** is embedded in the membranes of the thylakoid sacs
- ❖ The grana are connected by membranous extensions of the thylakoid sacs called **stroma lamellae**

Oh boy! There he goes again with vocab words...



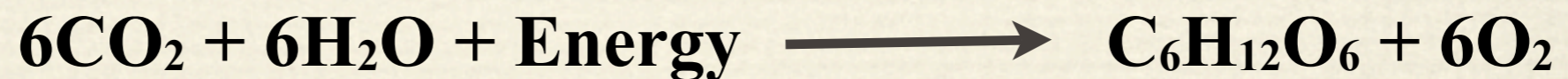
V
OC
AB





Chloroplasts

- ❖ Chloroplasts are the site of **photosynthesis**
- ❖ During this process, sunlight energy is trapped by the chloroplasts and used to make carbohydrates
- ❖ Thus solar energy is being converted to chemical energy
- ❖ The reactant molecules are the gas carbon dioxide and water
- ❖ Oxygen gas is a byproduct of the reaction





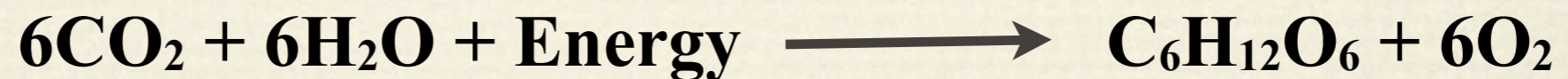
Chloroplasts


- ❖ Chloroplasts are the site of **photosynthesis**
- ❖ During this process, sunlight energy is trapped by the chloroplasts and used to make carbohydrates
- ❖ Thus solar energy is being converted to chemical energy
- ❖ The reactant molecules are the gas carbon dioxide and water
- ❖ Oxygen gas is a byproduct of the reaction



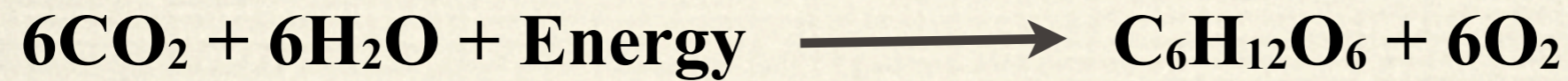
Hey!
That looks
familiar!

V
OC
AB



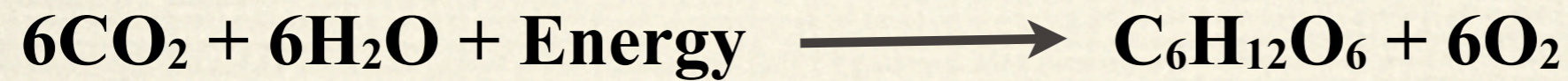


Looking Back...



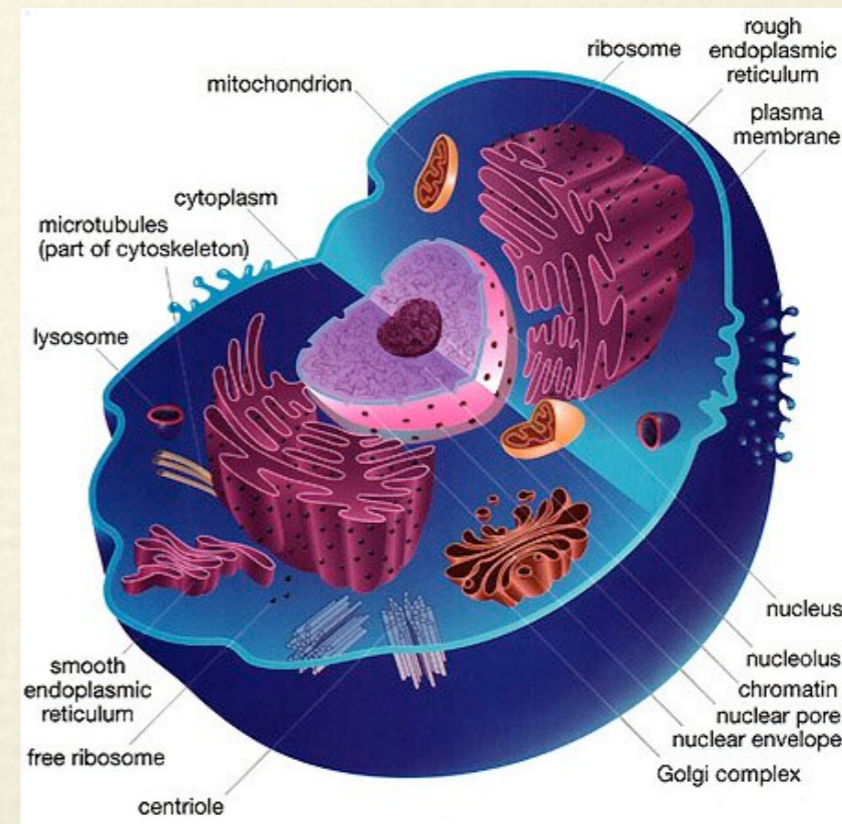
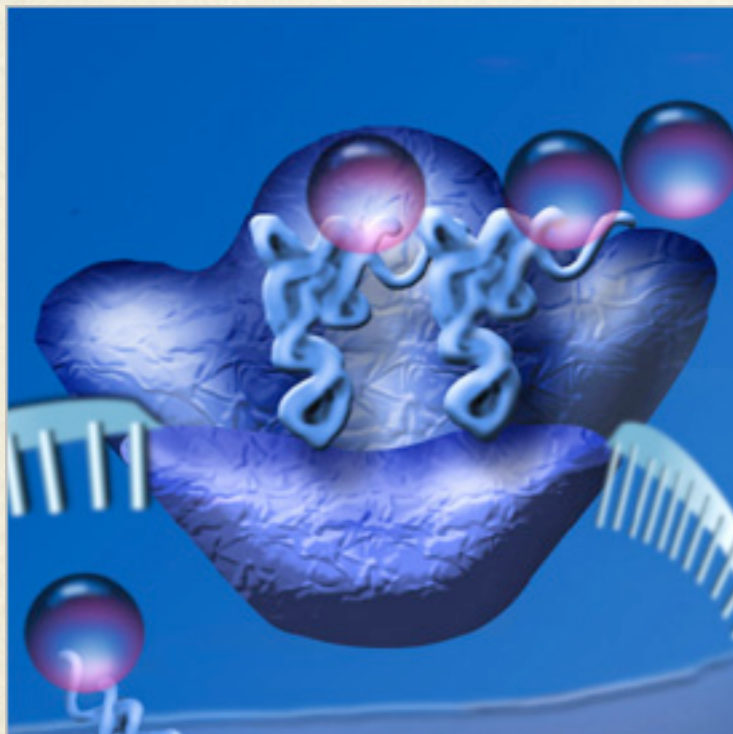


Looking Back...



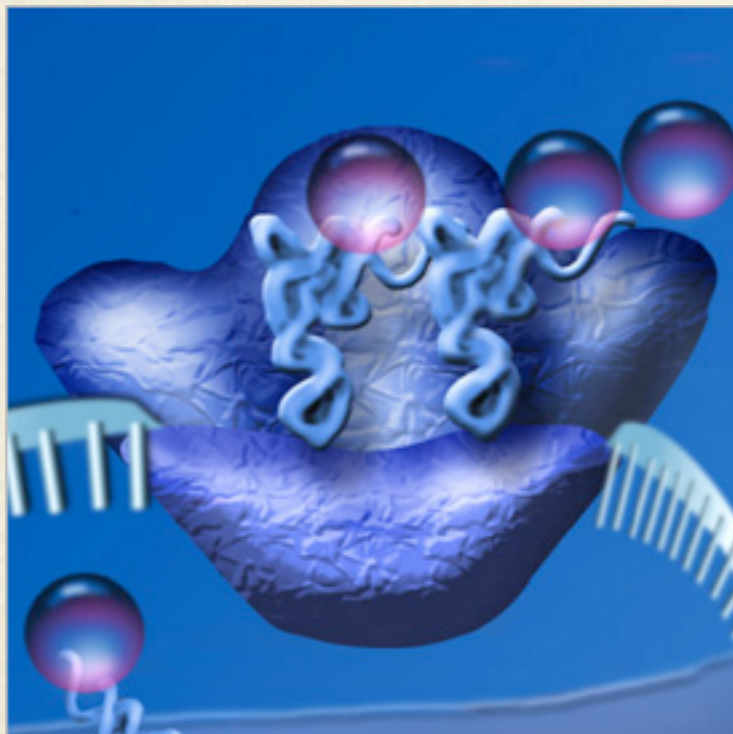
Ribosomes

- ❖ Ribosomes are made up of large and small subunits
- ❖ Both subunits consists of rRNA and protein
- ❖ They may be attached to the rough endoplasmic reticulum, or they may float freely in the cytoplasm



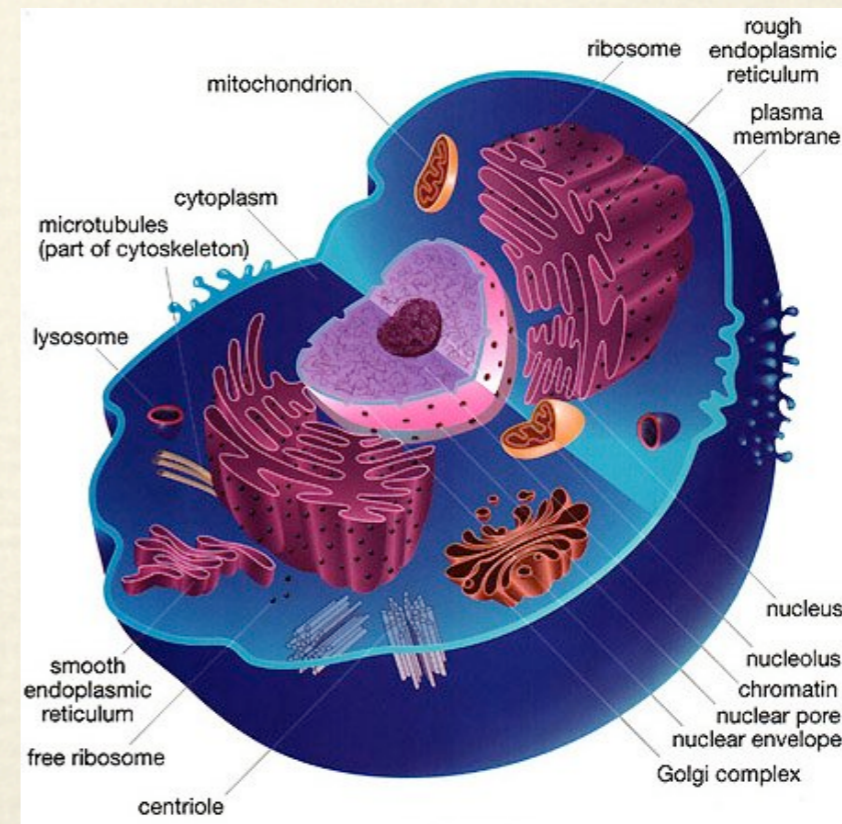
Ribosomes

- ❖ Ribosomes are made up of large and small subunits
- ❖ Both subunits consists of rRNA and protein
- ❖ They may be attached to the rough endoplasmic reticulum, or they may float freely in the cytoplasm



I can't see
any
ribosomes...

V
OC
AB



mitochondrion

ribosome

rough
endoplasmic
reticulum

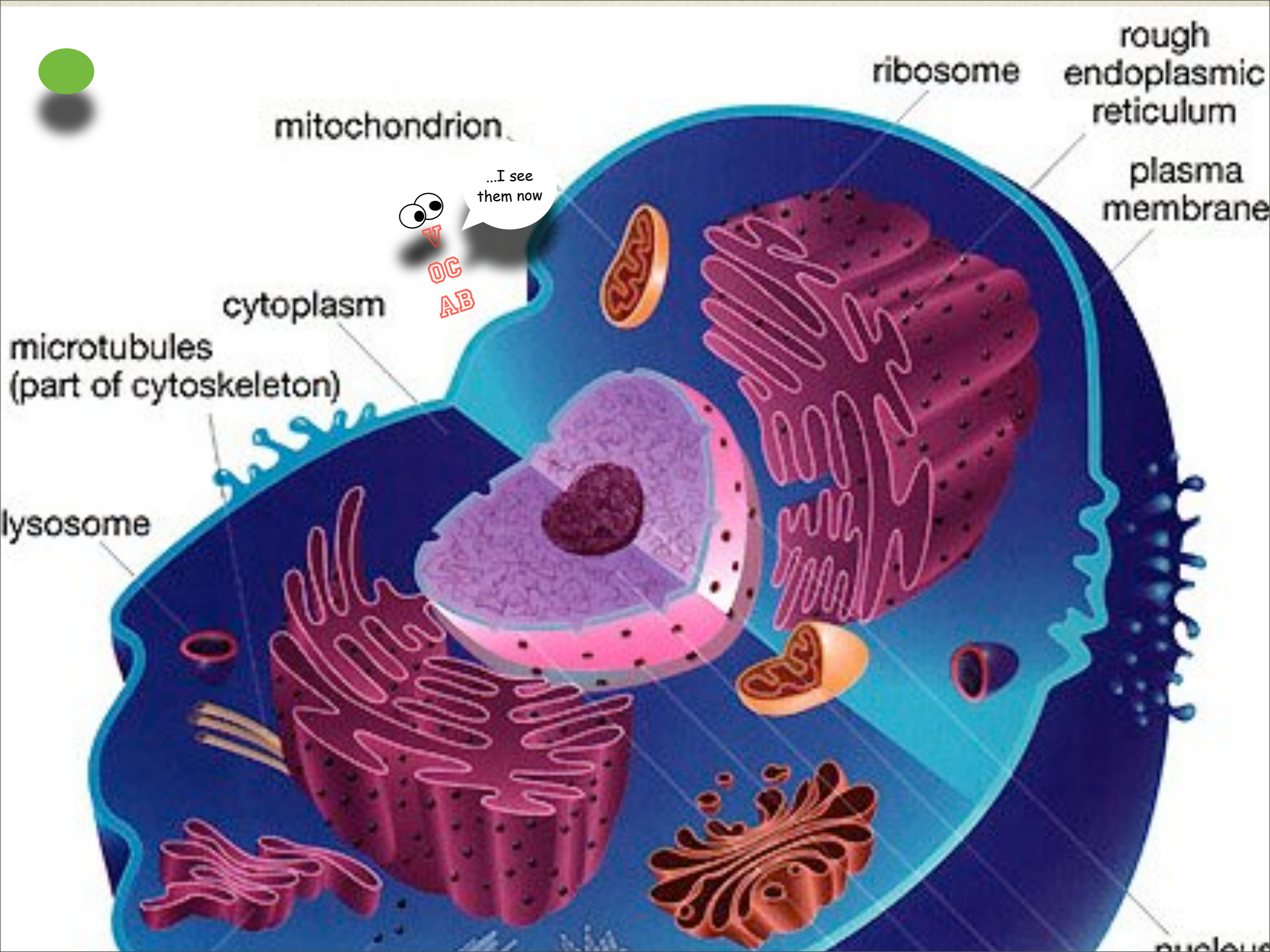
plasma
membrane

...I see
them now

cytoplasm

microtubules
(part of cytoskeleton)

lysosome





Ribosomes

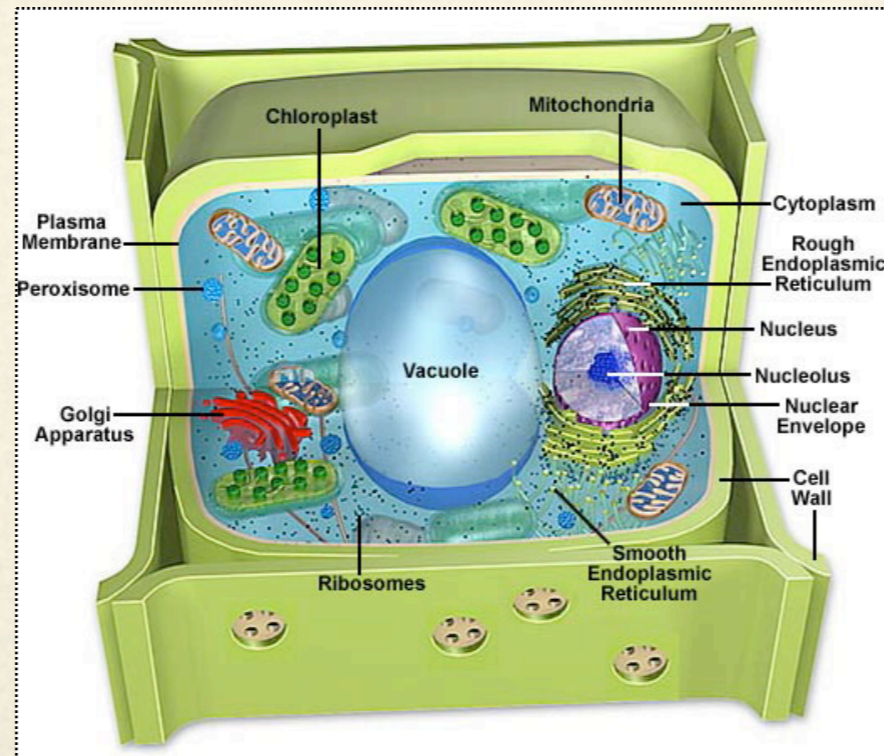
Function

- ❖ Used in the part of protein synthesis called translation
- ❖ Proteins produced by ribosomes on rough ER are transferred to the golgi and packaged into **vesicles** which transport them throughout the cell or to the cell membrane where they are exported to the outside of the cell
- ❖ Groups of ribosomes are called **polyribosomes**
- ❖ Polyribosomes produce multiple copies of the same protein

Vacuoles and Vesicles

Structure

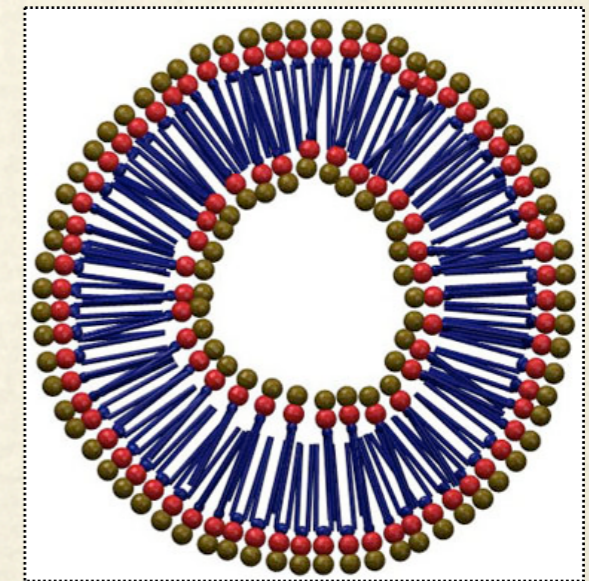
- ❖ Vacuoles and vesicles are both membrane bound sac-like structures that are used for storage
- ❖ Vesicles are smaller than vacuoles



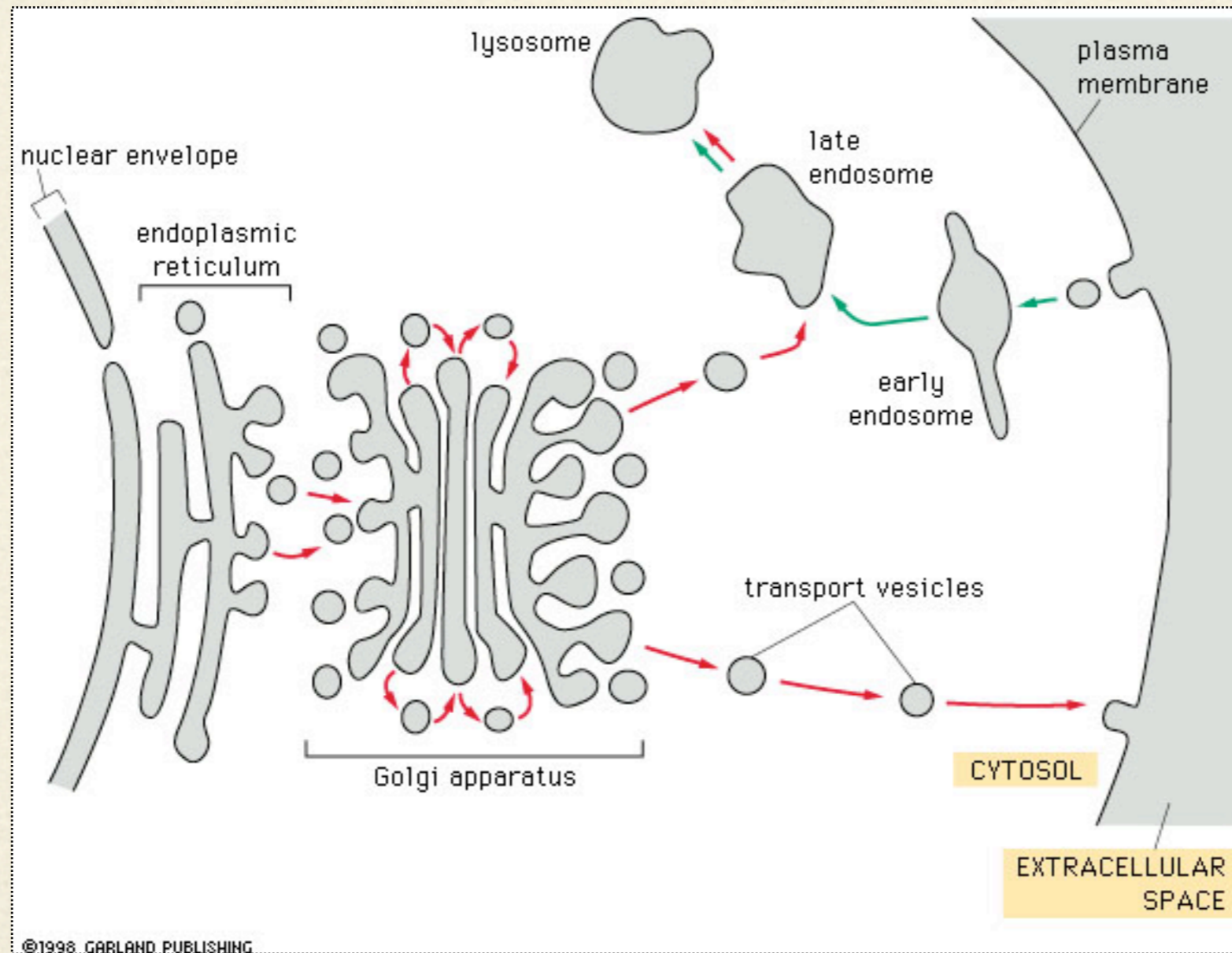
Vacuoles and Vesicles

Function

- ❖ Storage of materials such as water, sugars, salts, pigments and wastes
- ❖ In single celled animals, vacuoles are more specialized and function in water balance and digestion of nutrients
- ❖ Vesicles are able to transport materials throughout the cell and to the cell membrane for export out of the cell



Vacuoles and Vesicles





Lysosomes

Structure

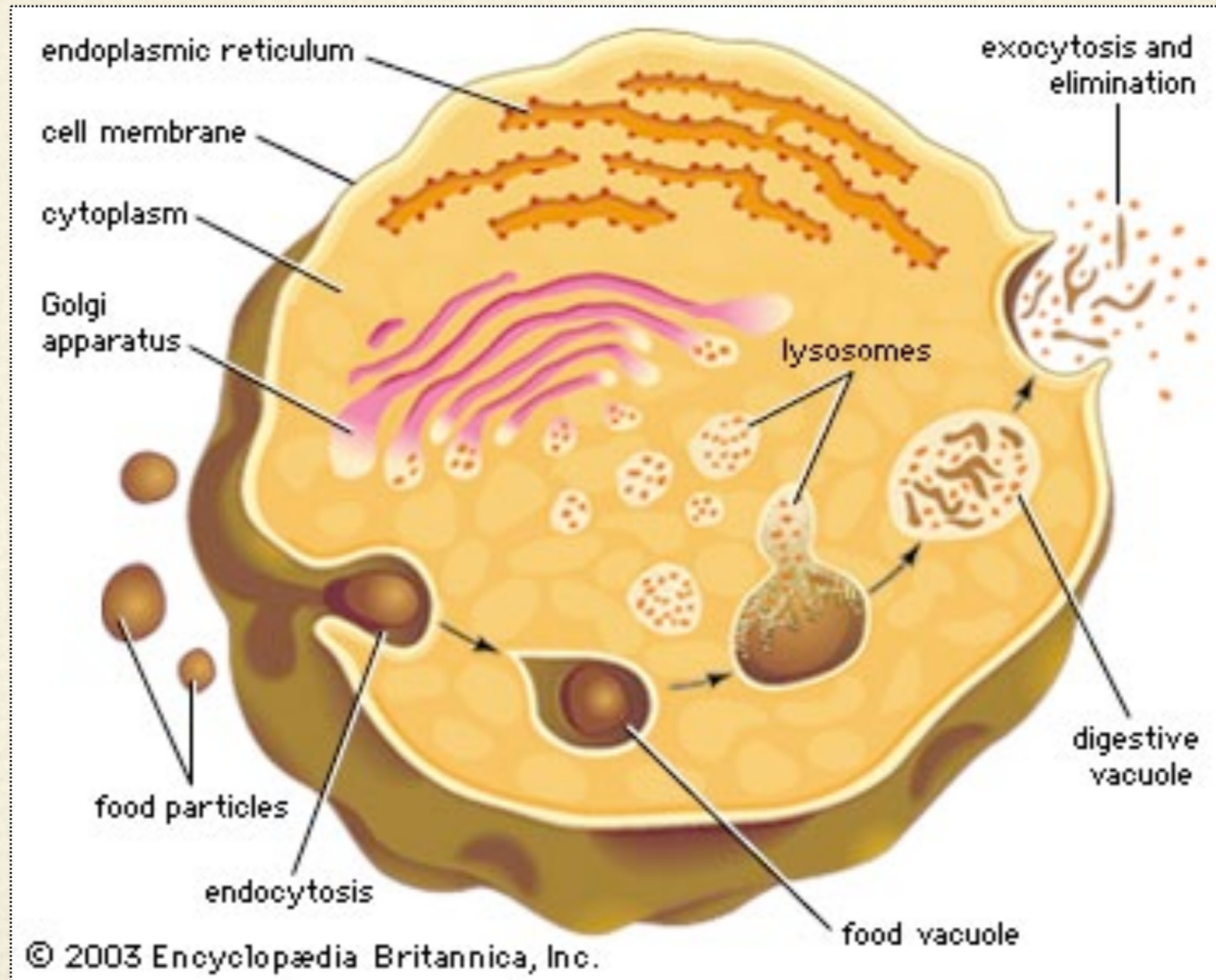
- ❖ Lysosomes are membrane bound vesicles produced by the golgi apparatus
- ❖ They contain **hydrolytic digestive enzymes**

Function

When vesicles bring macromolecules or pathogens into a cell, a lysosome will fuse with the vesicle and digest its contents

Lysosomes can also digest the cell's own contents, this is called **autodigestion** and is needed for normal cell rejuvenation

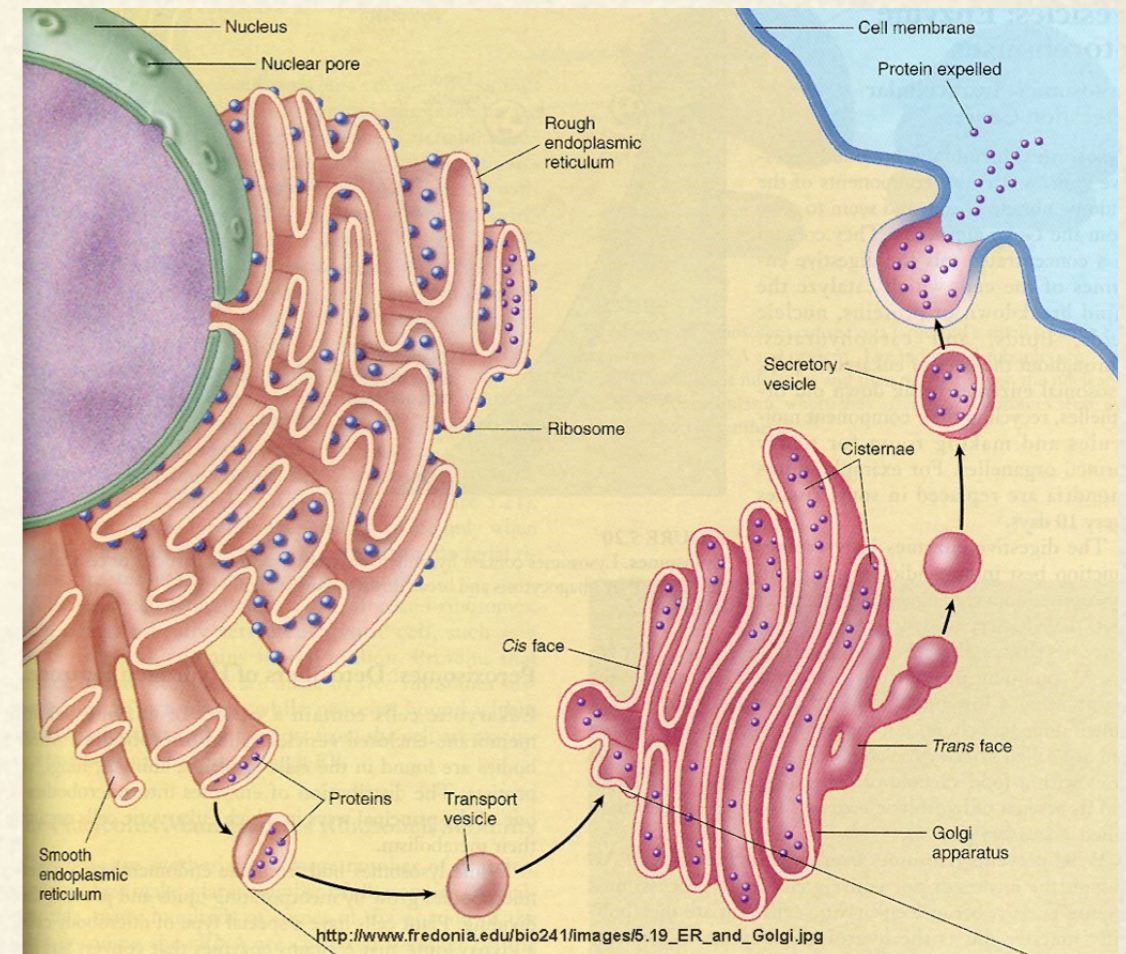
Lysosomes



Endoplasmic Reticulum (ER)

Structure

- ❖ The ER is a system of membranous channels and **sacculles** (flattened vesicles)
- ❖ It extends from the outer membrane of the nuclear membrane into the cytoplasm
- ❖ **Rough ER**-has ribosomes on its surface
- ❖ **Smooth ER**-does not have ribosomes the smooth and the



Endoplasmic Reticulum (ER)

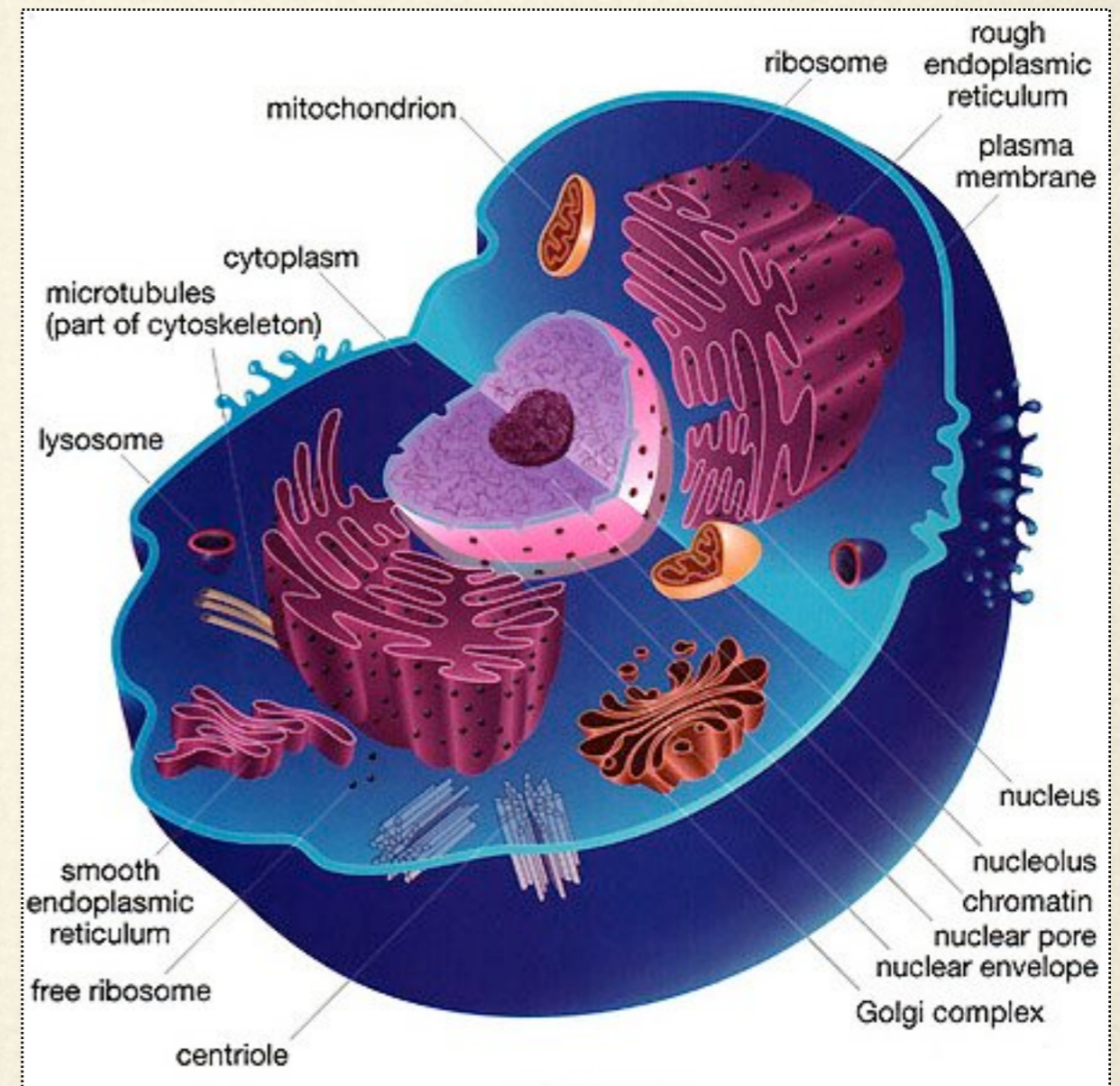
Function

- ❖ Since ER consists of membranous channels, it can transport molecules
- ❖ Rough ER is involved in protein synthesis due to the ribosomes on its surface
- ❖ Smooth ER forms vesicles in which proteins are transported
- ❖ Smooth ER synthesizes phospholipids which are needed in cell membranes
- ❖ Smooth ER also has specialized functions depending on the cell type (Eg- produces testosterone in the testes & detoxifies drugs in the liver)

Golgi Apparatus

Structure

- ❖ The golgi apparatus consists of 3-20 stacked saccules
- ❖ In animals, the inner surface of the stack faces the ER while the outer face faces the cell membrane
- ❖ There are often vesicles around the edges of the golgi



[illegible]

Golgi Apparatus

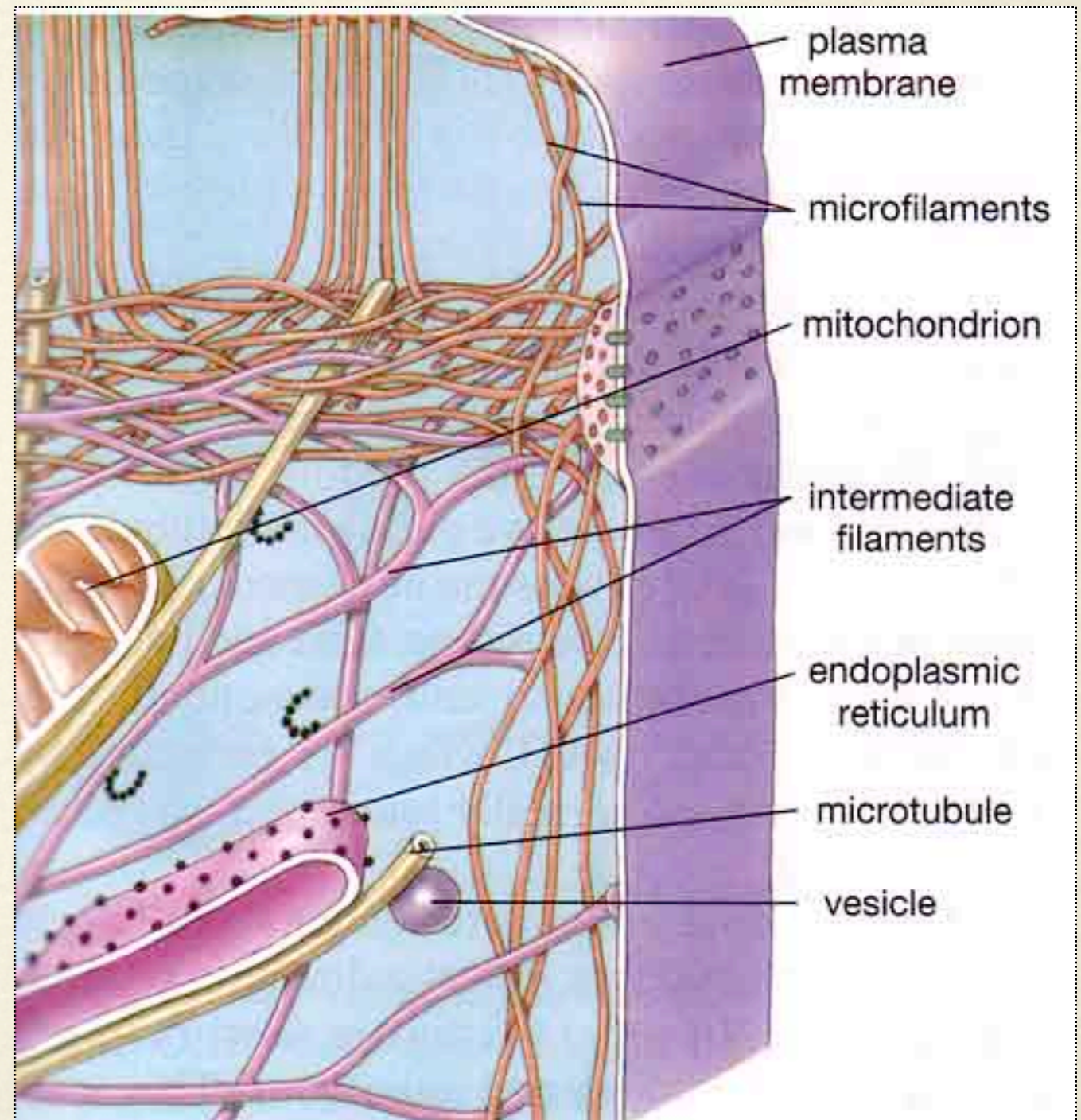
Function

- ❖ The golgi receives vesicles containing protein or lipid from the ER
- ❖ These molecules move through the golgi from the inner face to the outer face
- ❖ The golgi processes and modifies these molecules
- ❖ The molecules are then repackaged into vesicles to be distributed throughout the cell
- ❖ Vesicles that contain molecules to be exported from the cell are called **secretory vesicles**

Cytoskeleton

Structure

- ❖ The cytoskeleton consists of a network of interconnected filamentous proteins which include **actin filaments (microfilaments)**, **microtubules**, and **intermediate filaments**
- ❖ The cytoskeleton is suspended in the cytoplasm and gives it a gel like consistency



Cytoskeleton

Function

- ❖ Provides an attachment site for cellular organelles and maintains cell structure
- ❖ Allows the cell to move and change shape

OVERVIEW

❖ Play “Overview of the Cell”