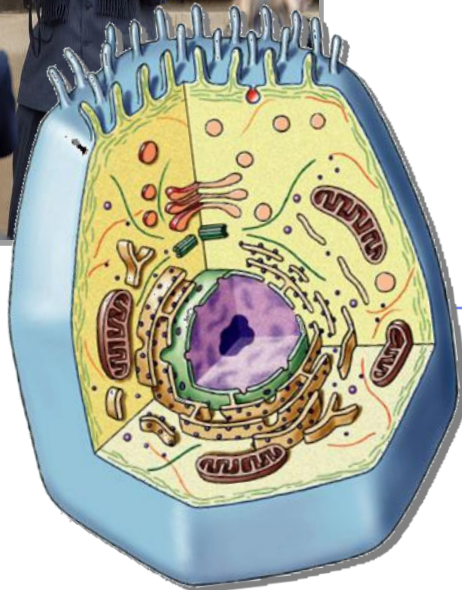
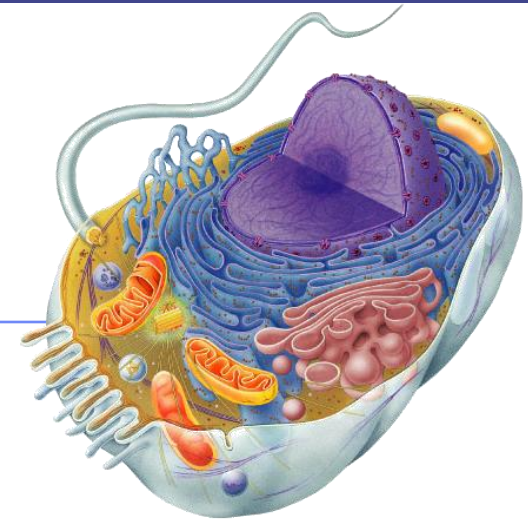
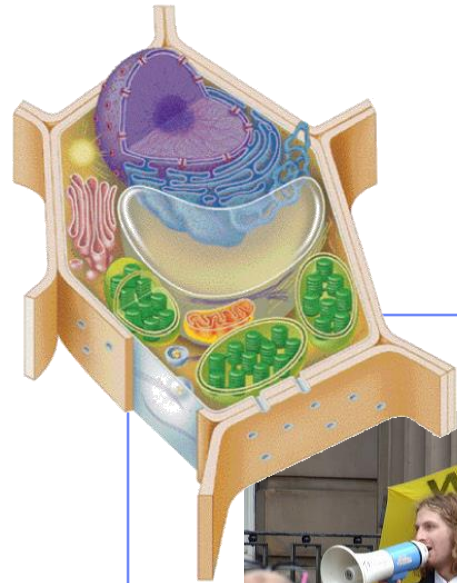


Thursday, October 16th

Good morning. Those of you needing to take the **Enzymes and Energy Quiz** will start very soon.

- Students who took the quiz Wednesday:
 - Please QUIETLY work on the chapter 6 reading guide.
 - You may also work on Q#1-2 on your gold **Unit 2** Homework packet, Chapter 6.

Tour of the Cell 1



Overview: The Fundamental Units of Life

The cell theory includes these statements:

- All organisms are made of cells
- The cell is the simplest collection of matter that can live
- Cell structure and cell function are related
- All cells come from earlier cells



To study cells, biologists use microscopes and the tools of biochemistry

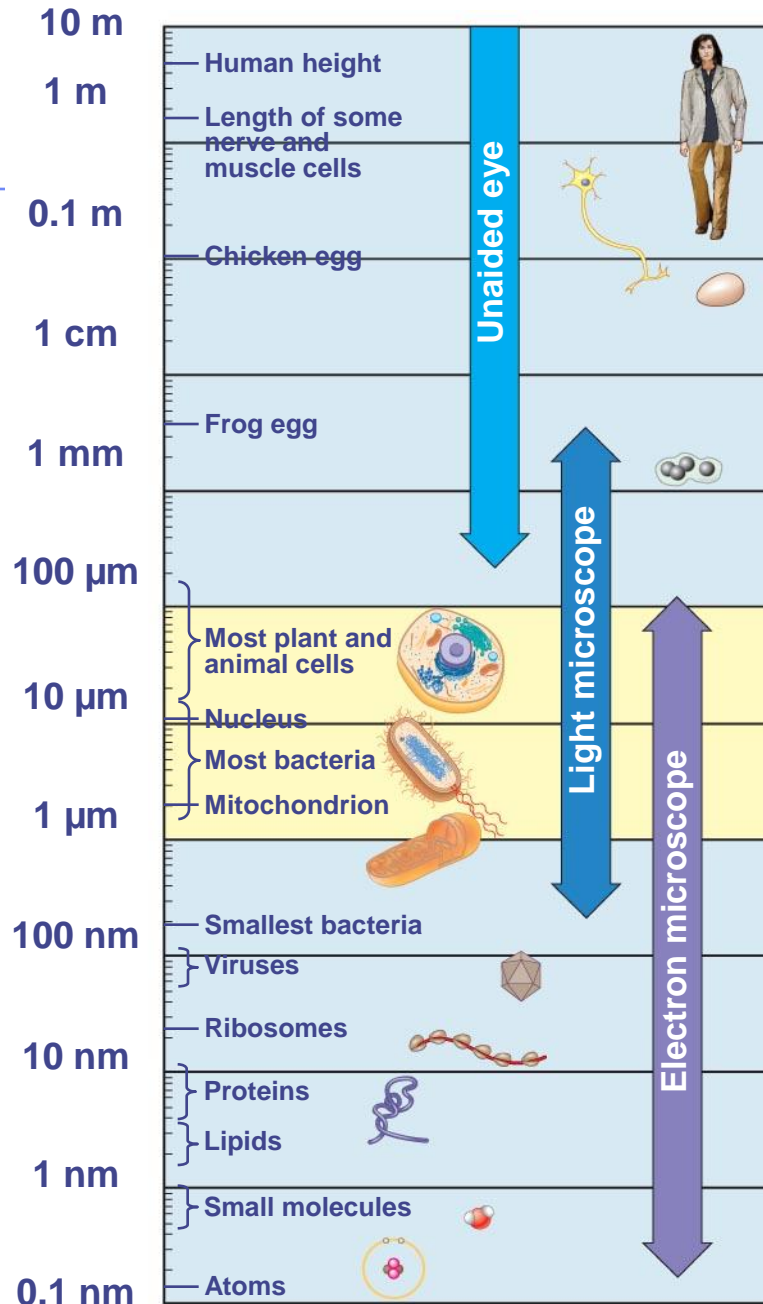
Microscopes are used to see cells and the complex details of cells invisible to the unaided eye


- **Light microscope** is the simplest
 - ◆ In a light microscope (LM), visible light passes through a specimen and then through glass lenses, magnifying the image
- <http://virtuallabs.nmsu.edu/micro.php>

The quality of an image depends on

- ◆ **Magnification-** ratio of an object's image size to its real size
- ◆ **Resolution-** measure of the image's clarity, or the minimum distance between two distinguishable points
- ◆ **Contrast-** visible differences in parts of the sample

Limitations of the light and electron microscopes



- 
- LM's effectively magnify a specimen's image to about 1,000 times its actual size.
 - Various techniques increase contrast and help cell components to be stained or labeled
 - ◆ Most subcellular structures, including organelles (membrane-enclosed compartments), are too small to be resolved by an LM

TECHNIQUE

RESULTS

TECHNIQUE

RESULTS

**(a) Brightfield
(unstained
specimen)**

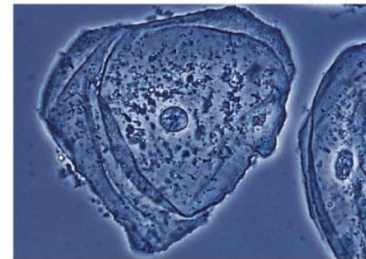


100 μm

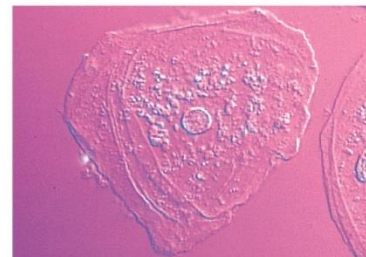
**(b) Brightfield (stained
specimen)**



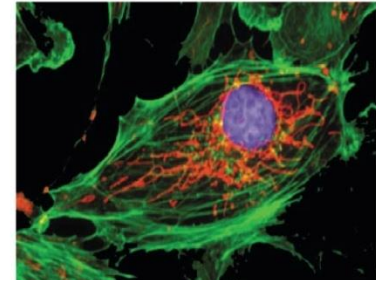
(c) Phase-contrast



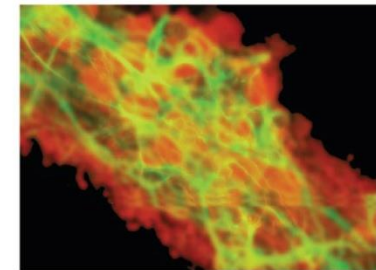
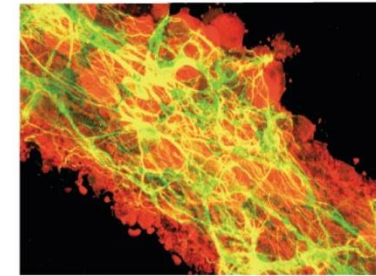
**(d) Differential-
interference-
contrast (Nomarski)**



(e) Fluorescence



(f) Confocal



100 μm

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Fig. 6-3

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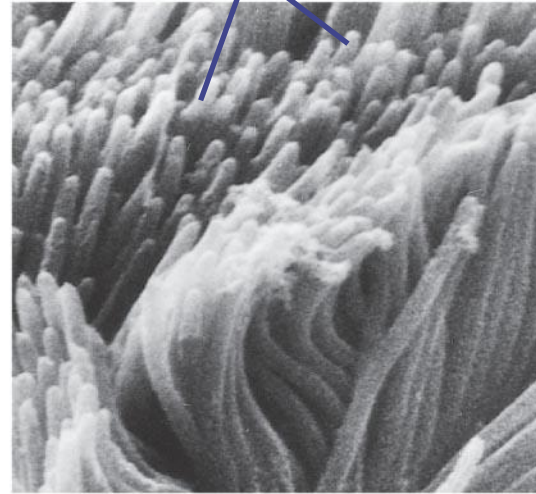
- **Electron microscopes (EMs)** are used to study subcellular structures
- **Scanning electron microscopes (SEMs)** focus a beam of electrons onto the surface of a specimen, giving images that look 3-D
- **Transmission electron microscopes (TEMs)** focus a beam of electrons through a specimen to study the internal structure of cells

TECHNIQUE

(a) Scanning electron microscopy (SEM)

RESULTS

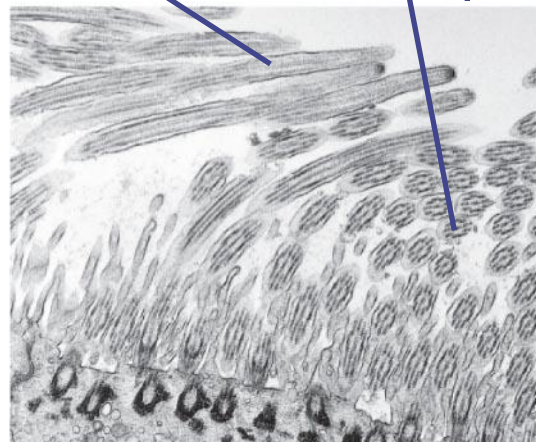
Cilia

1 μm 

(b) Transmission electron microscopy (TEM)

Longitudinal section of cilium

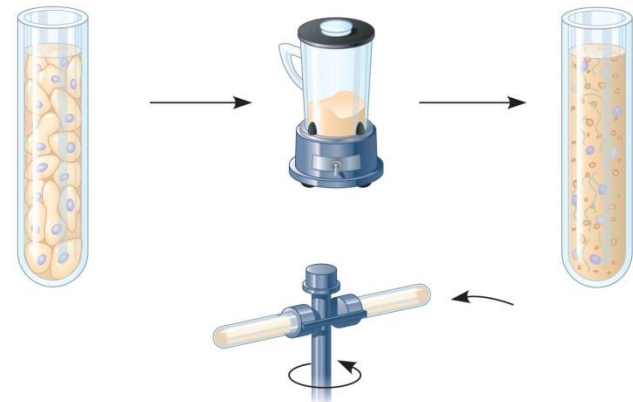
Cross section of cilium

1 μm 

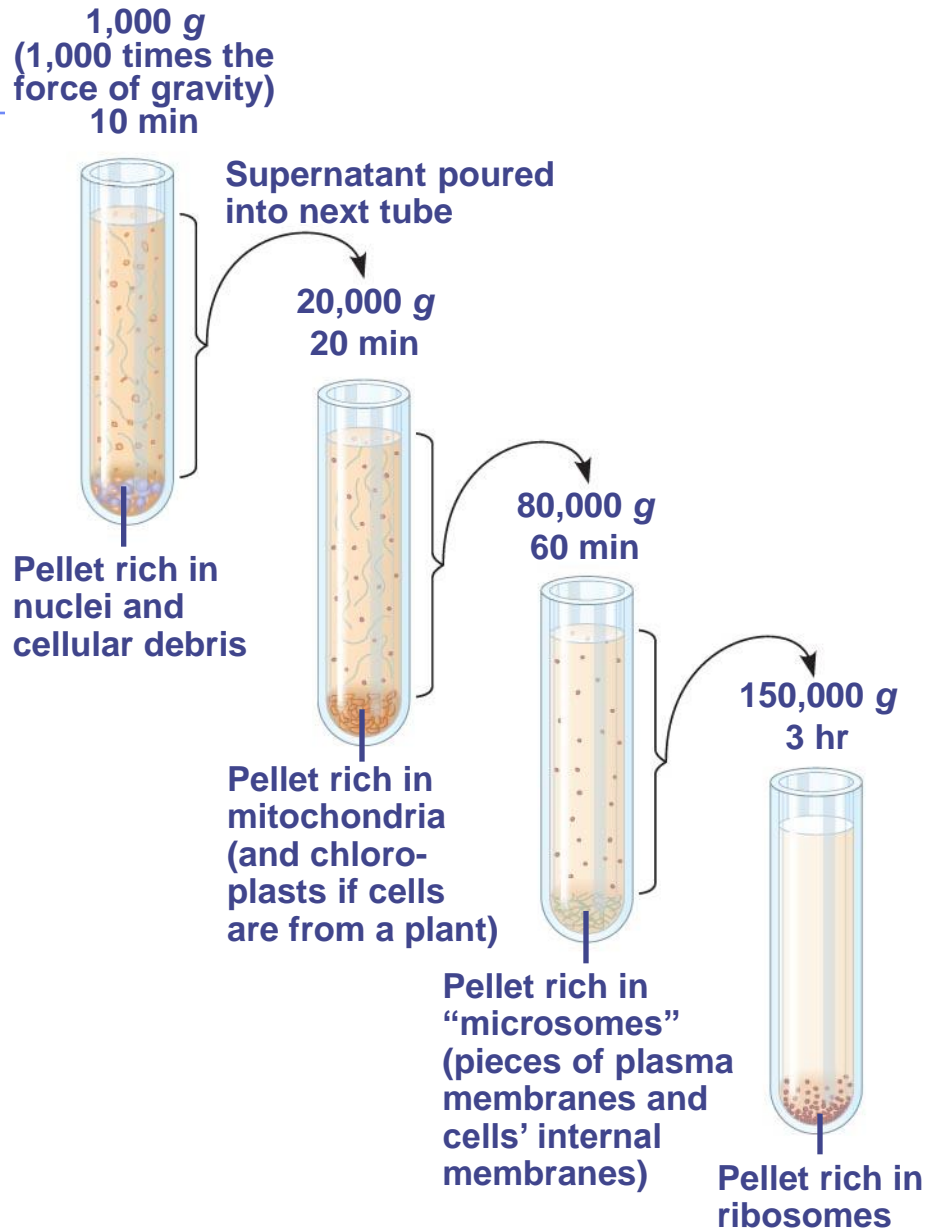
Cell Fractionation

Cell fractionation breaks cells and separates major organelles from each other using ultracentrifuges

- This lets scientists determine the **functions** of organelles
- Biochemistry and cytology help correlate cell function with structure



TECHNIQUE (cont.)



To be eukaryotic or not to be...

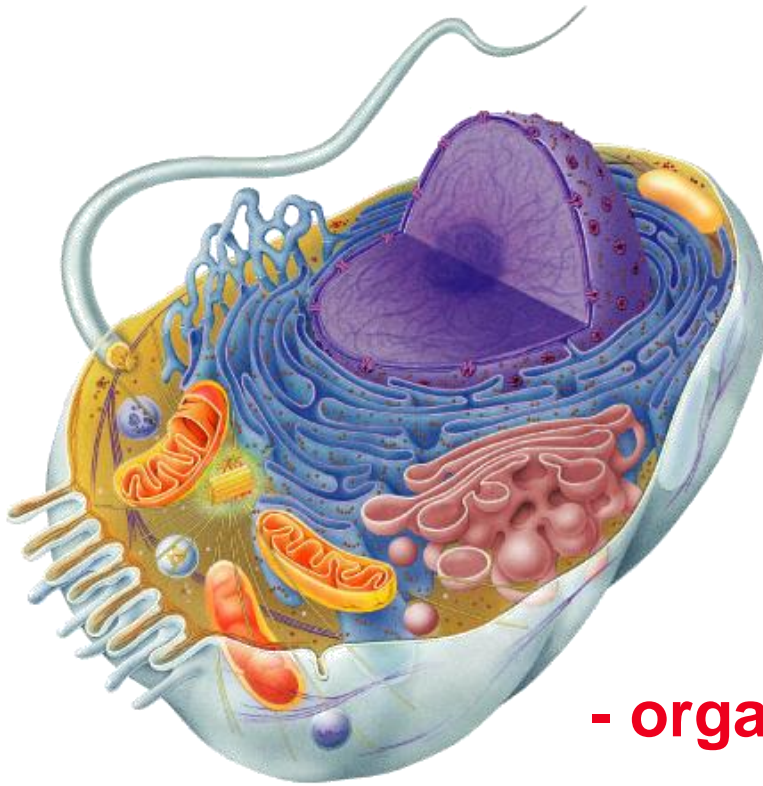
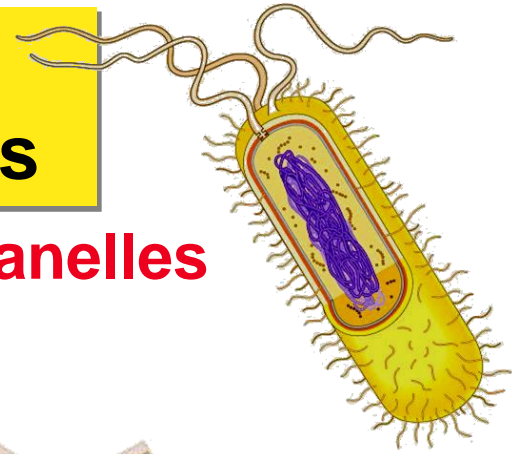
All cells are either prokaryotic or eukaryotic cells

- Bacteria & Archaeabacteria are **prokaryotic** cells
- Protists, fungi, animals, and plants are **eukaryotic** cells
- Basic features of all cells:
 - ◆ Plasma membrane
 - ◆ Semifluid substance called cytosol
 - ◆ Chromosomes (carry genes)
 - ◆ Ribosomes (make proteins)

Types of cells

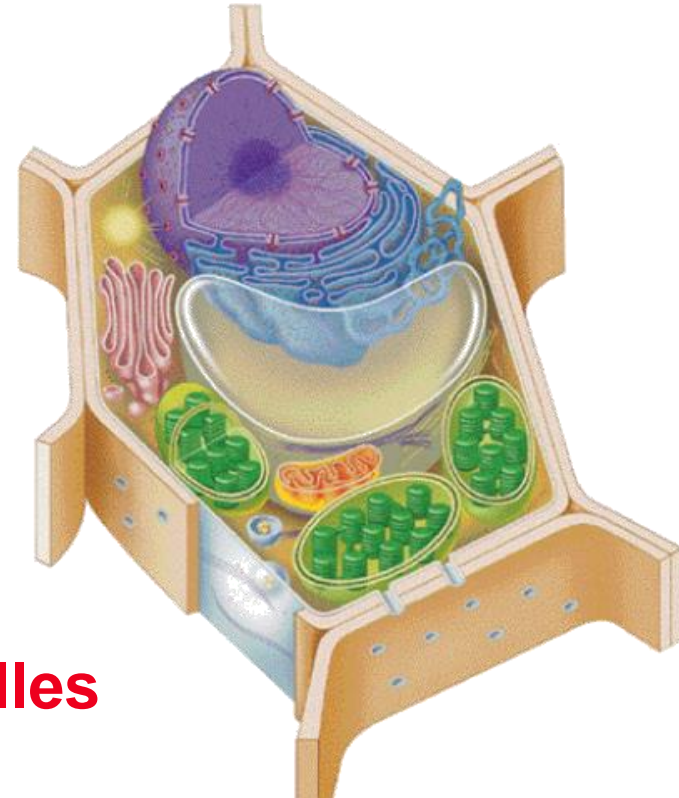
**Prokaryote
bacteria cells**

- no organelles



- organelles

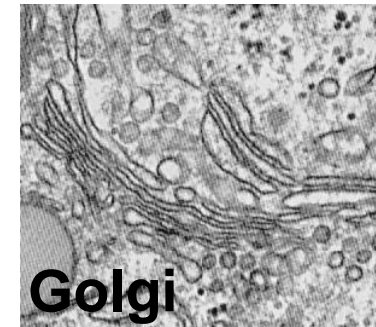
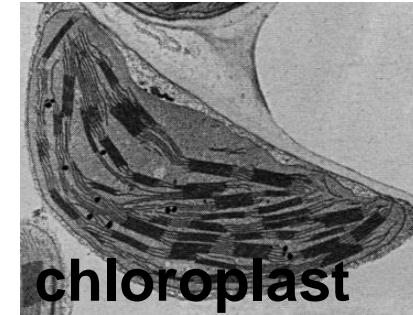
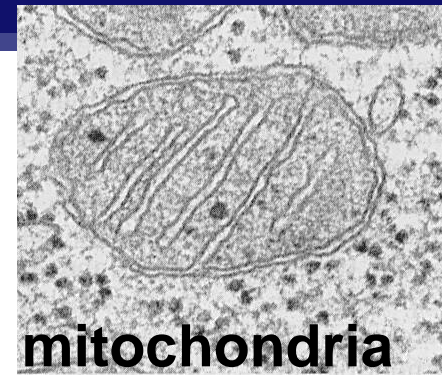
**Eukaryote
animal cells**



**Eukaryote
plant cells**

Why organelles?

- **Specialized structures**
 - ◆ specialized functions
 - cilia or flagella for locomotion
- **Containers**
 - ◆ partition cell into compartments
 - ◆ create different local environments
 - separate pH, or concentration of materials
 - ◆ distinct & incompatible functions
 - lysosome & its digestive enzymes
- **Membranes as sites for chemical reactions**
 - ◆ unique combinations of lipids & proteins
 - ◆ embedded enzymes & reaction centers
 - chloroplasts & mitochondria



Cells gotta work to live!

■ What jobs do cells have to do?

◆ make proteins

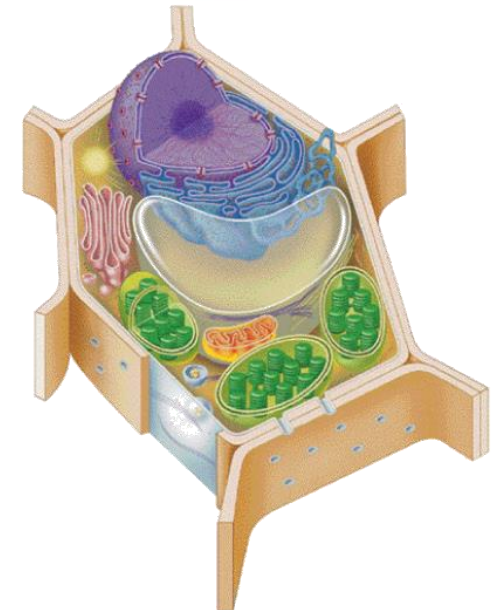
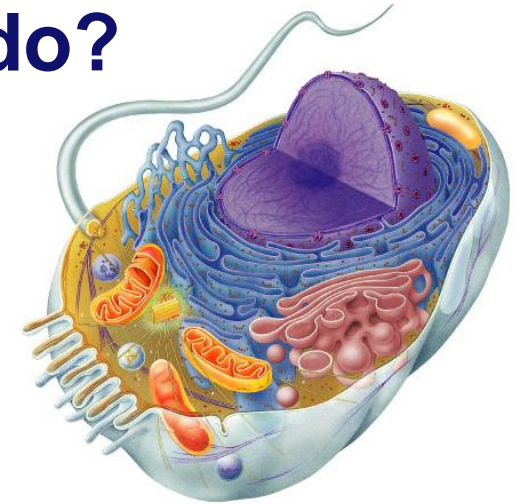
- proteins control every cell function

◆ make energy

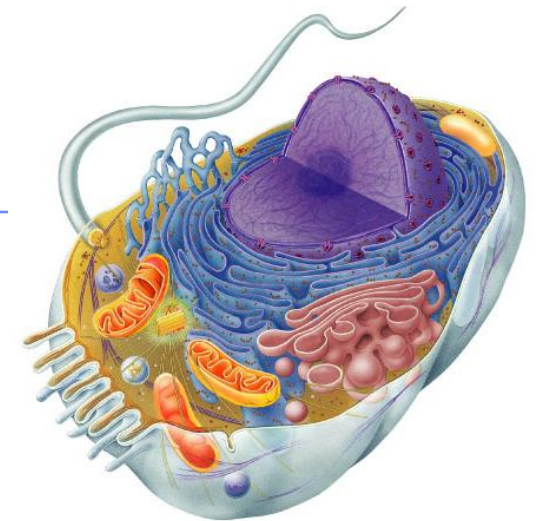
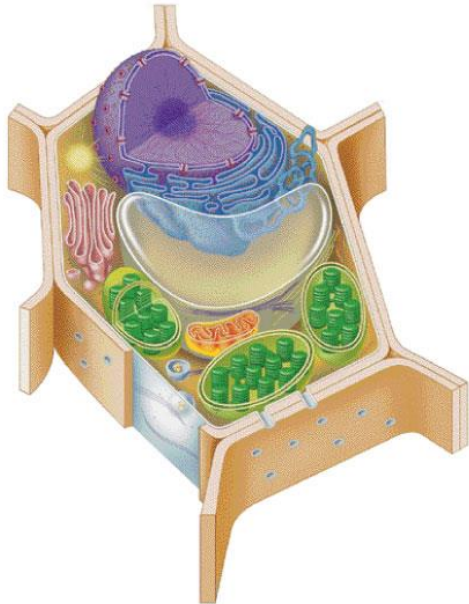
- for daily life
- for growth

◆ make more cells

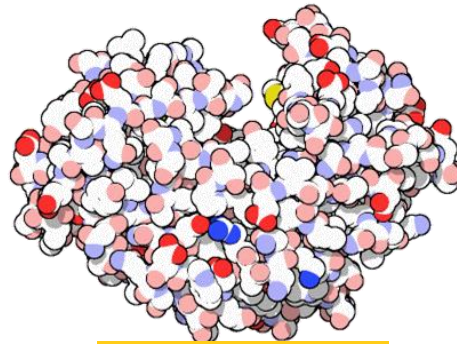
- growth
- repair
- renewal



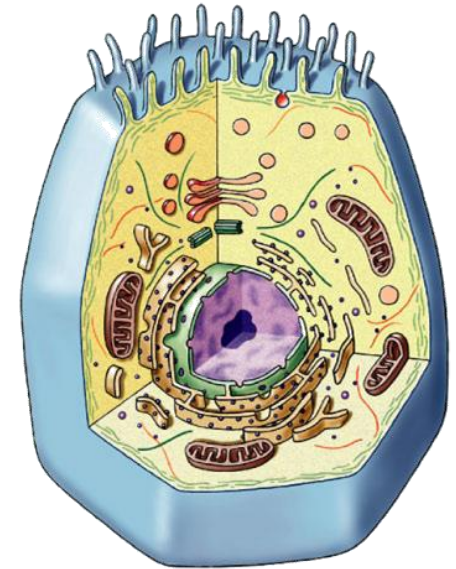
Building Proteins



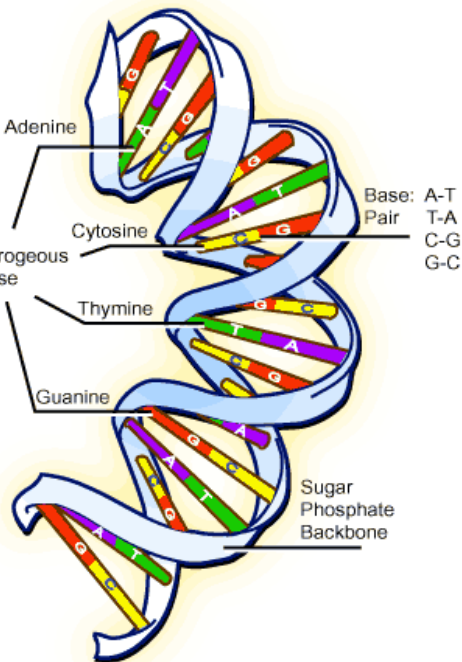
Proteins do all the work!



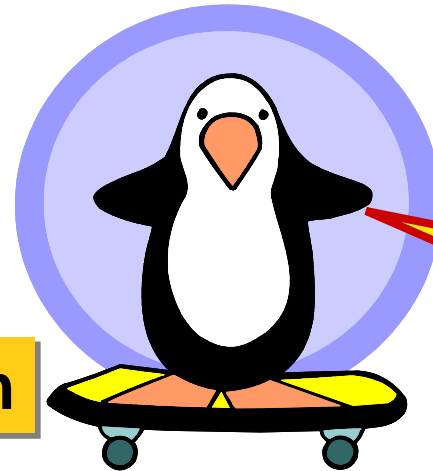
proteins



cells



DNA



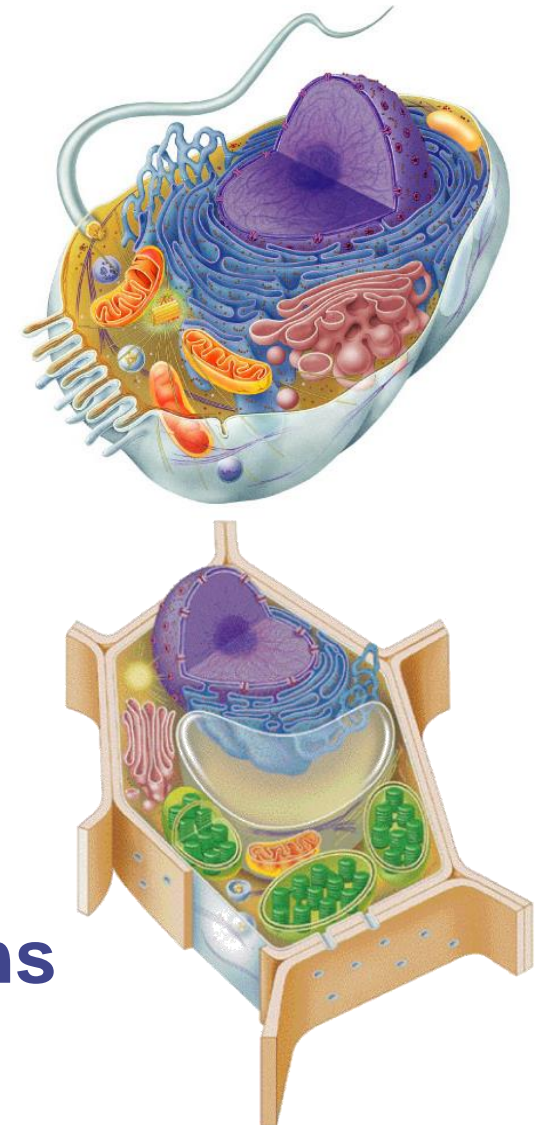
organism

Repeat after me...
Proteins do all the work!

Cells functions

■ Building proteins

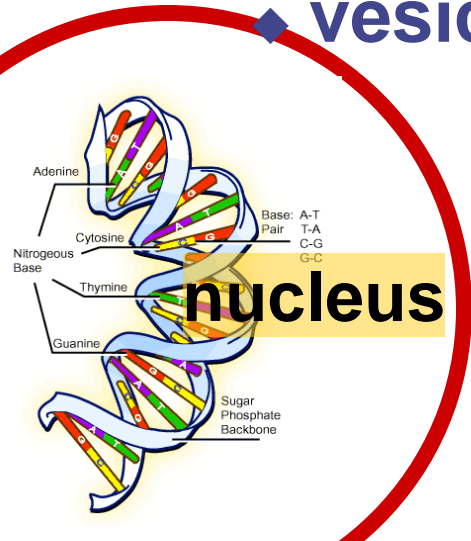
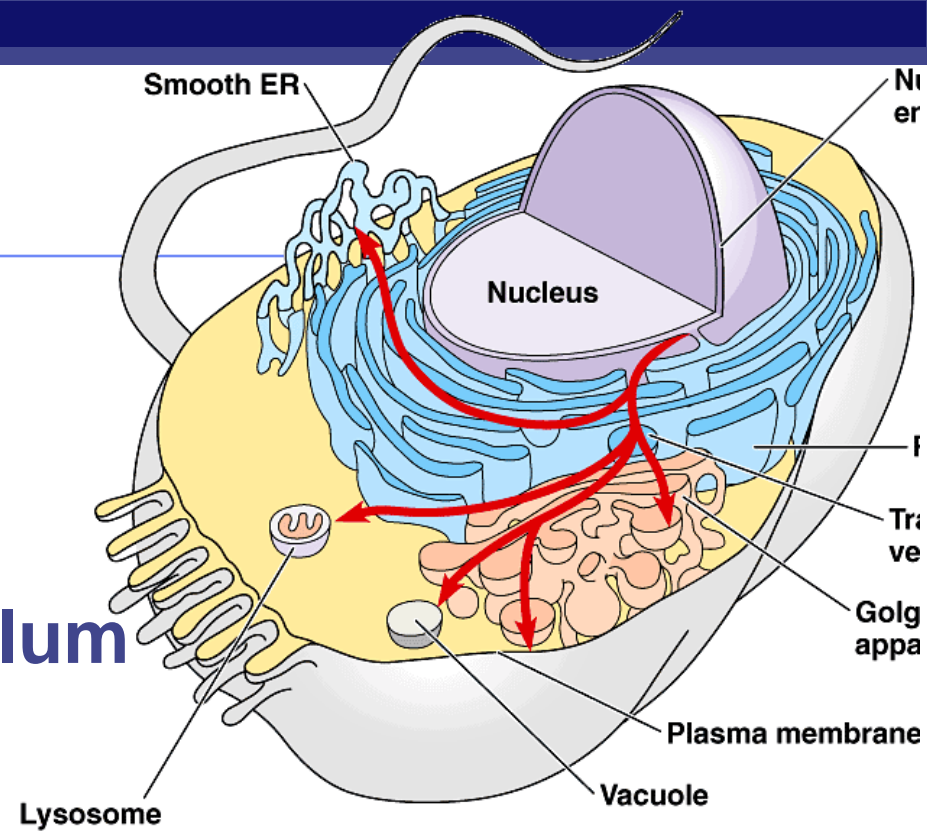
- ◆ read DNA instructions
- ◆ build proteins
- ◆ process proteins
 - folding
 - modifying
 - ◆ removing amino acids
 - ◆ adding other molecules
 - e.g, making glycoproteins for cell membrane
- ◆ address & transport proteins



Building Proteins

Organelles involved

- ◆ nucleus
- ◆ ribosomes
- ◆ endoplasmic reticulum (ER)
- ◆ Golgi apparatus
- ◆ vesicles



The Protein Assembly Line

nucleus

ribosome

ER

Golgi apparatus

vesicles

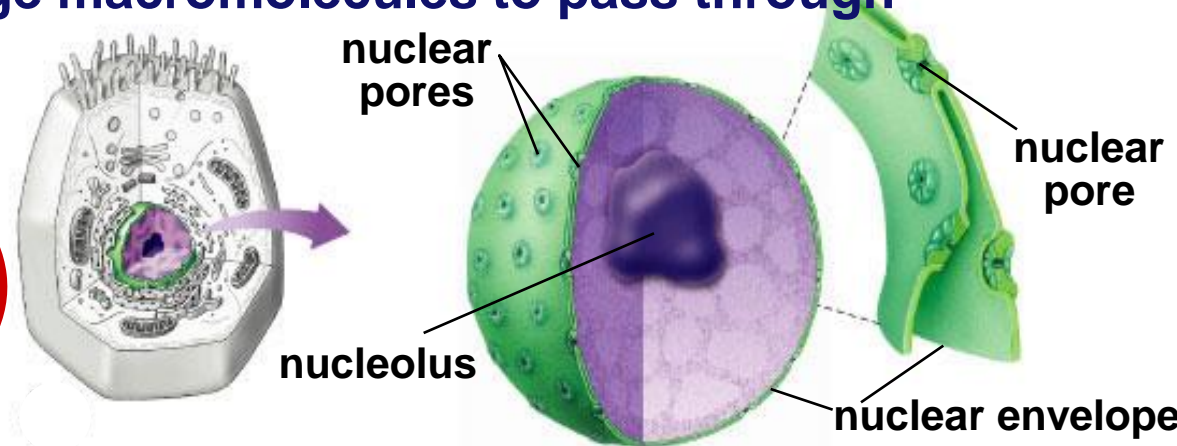
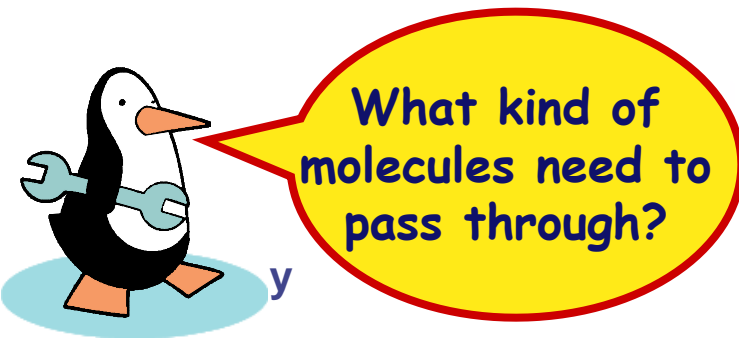
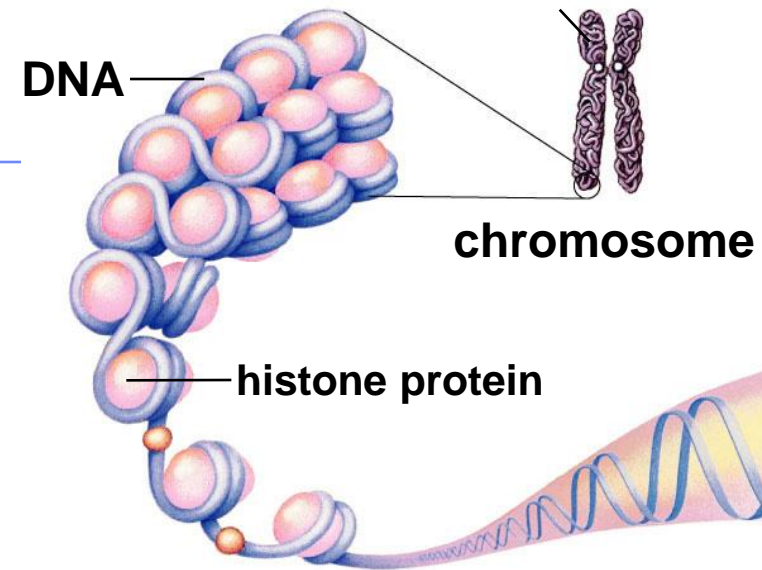
Nucleus

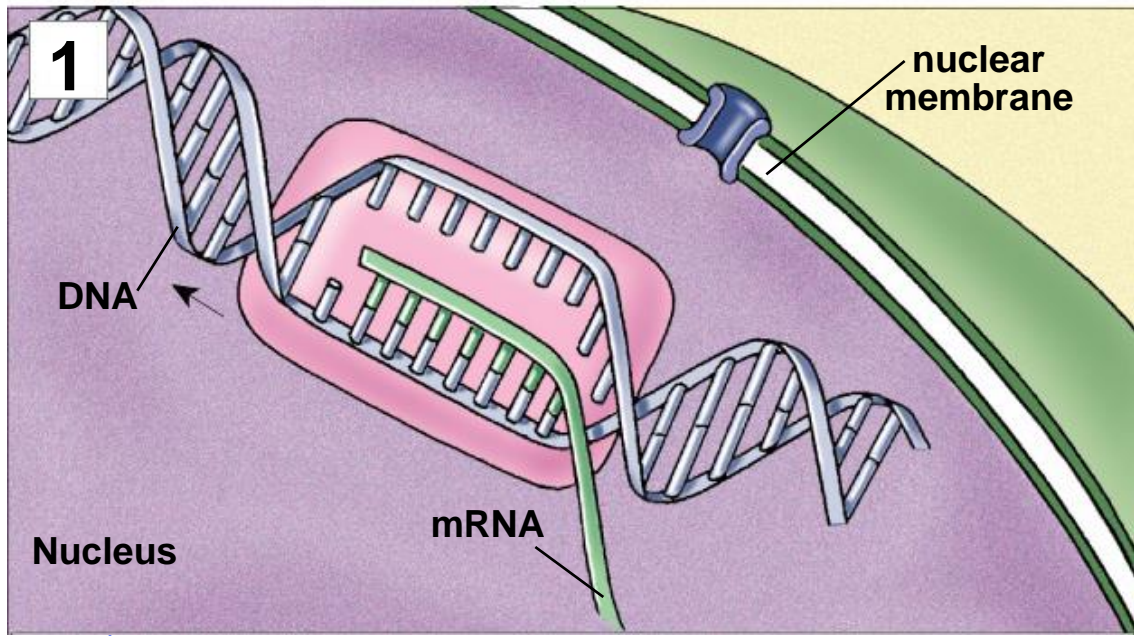
■ Function

- ◆ protects DNA

■ Structure

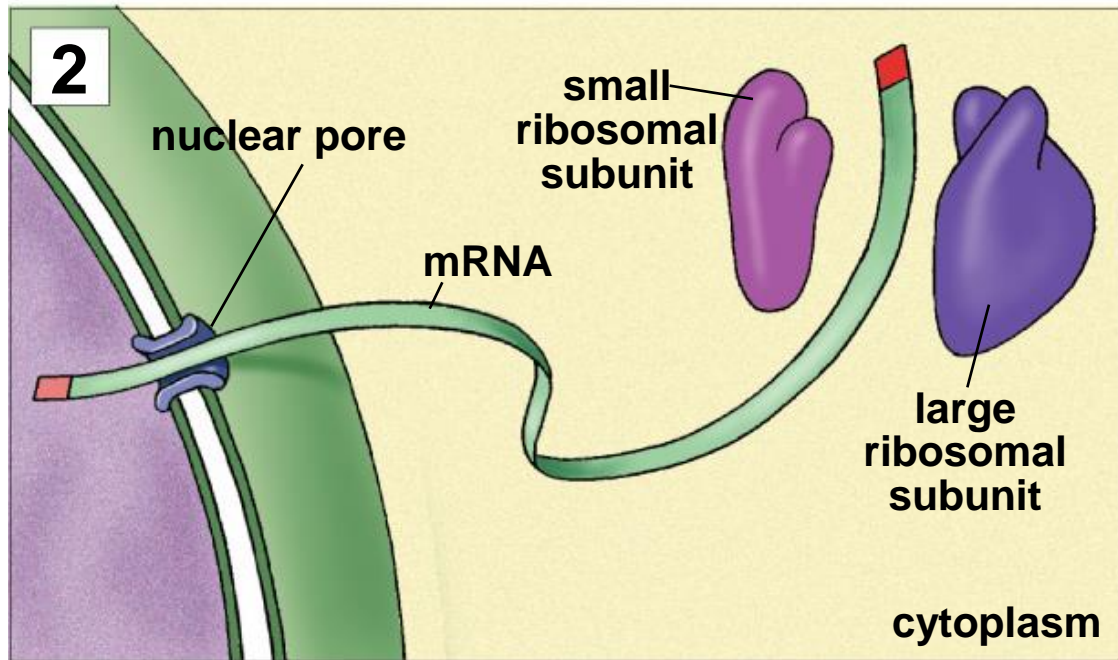
- ◆ nuclear envelope
 - double membrane
 - membrane fused in spots to create pores
 - ◆ allows large macromolecules to pass through

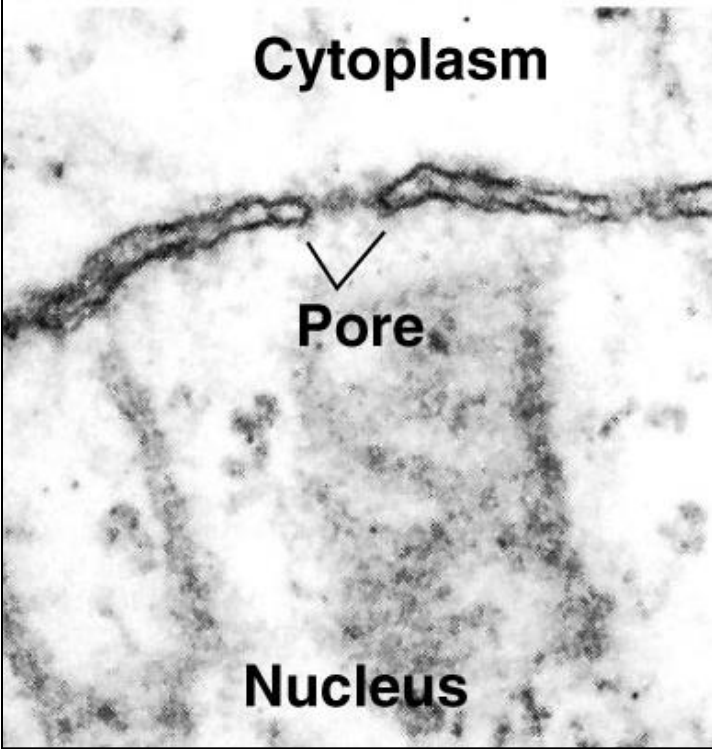
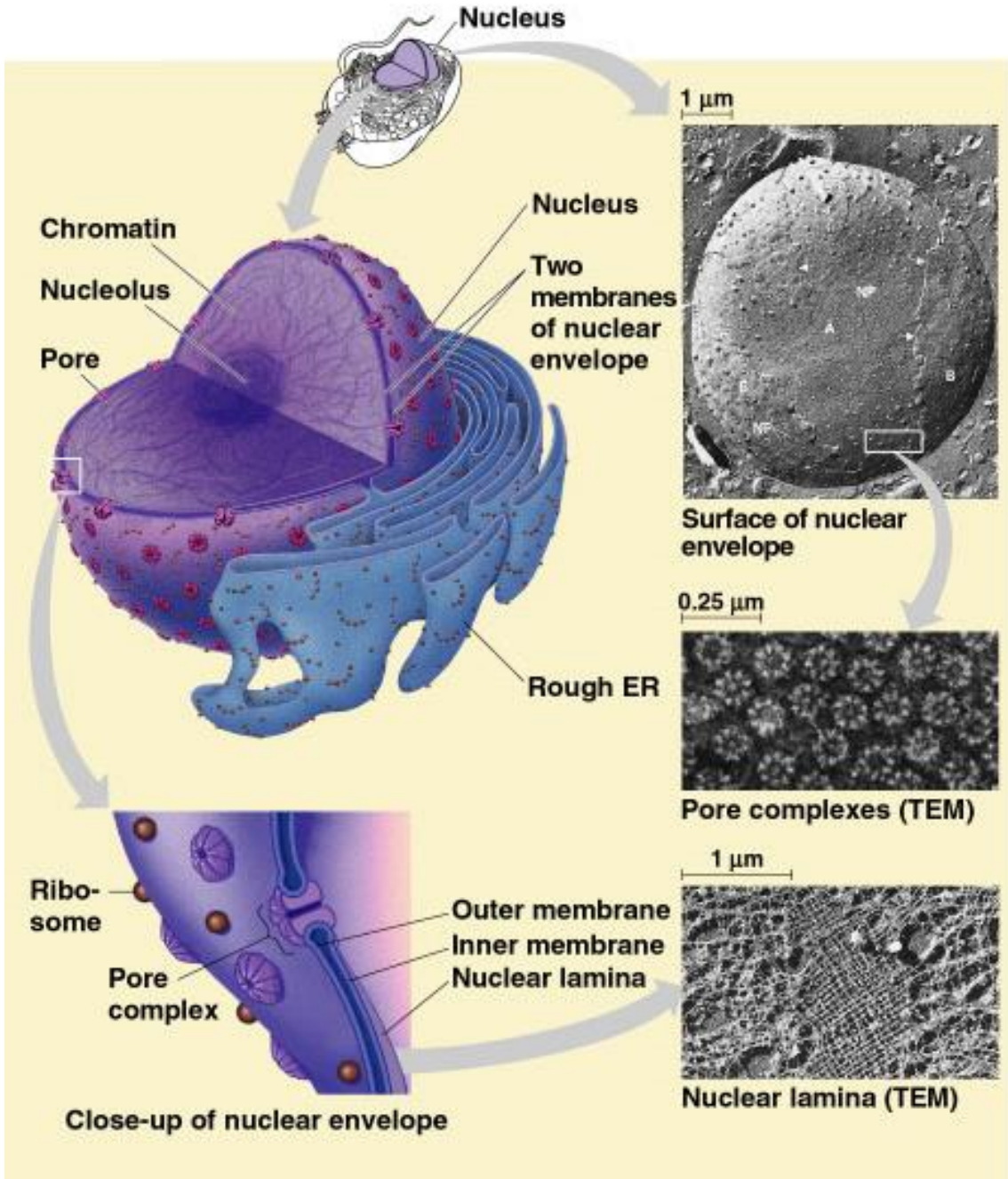




production of mRNA from DNA in nucleus

mRNA travels from nucleus to ribosome in cytoplasm through nuclear pore



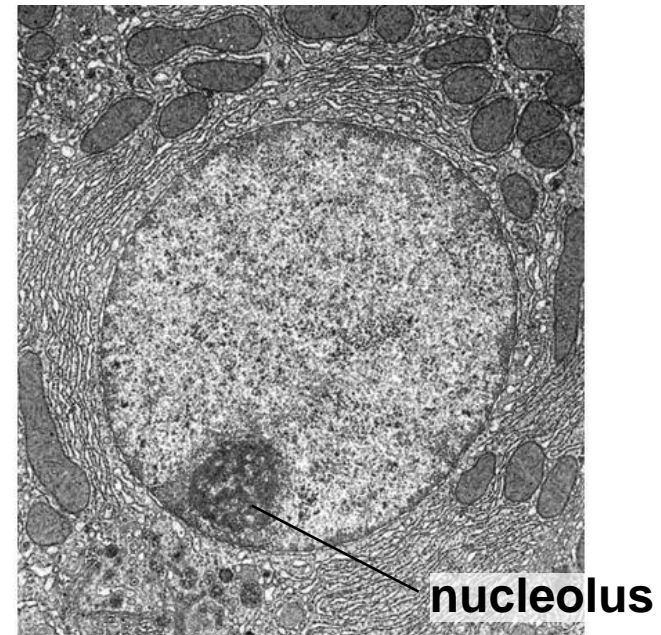
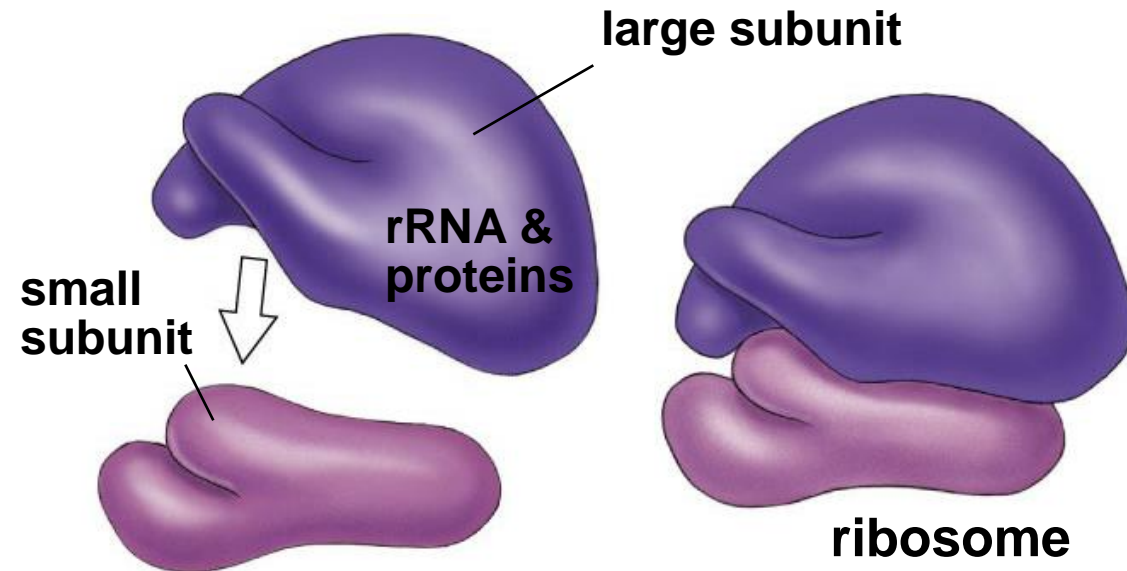


Nucleolus

■ Function

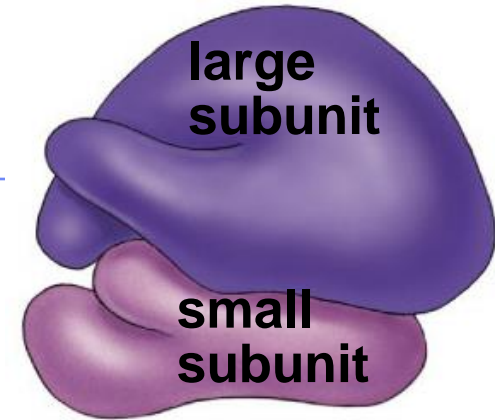
◆ ribosome production

- build ribosome subunits from rRNA & proteins
- exit through nuclear pores to cytoplasm & combine to form functional ribosomes

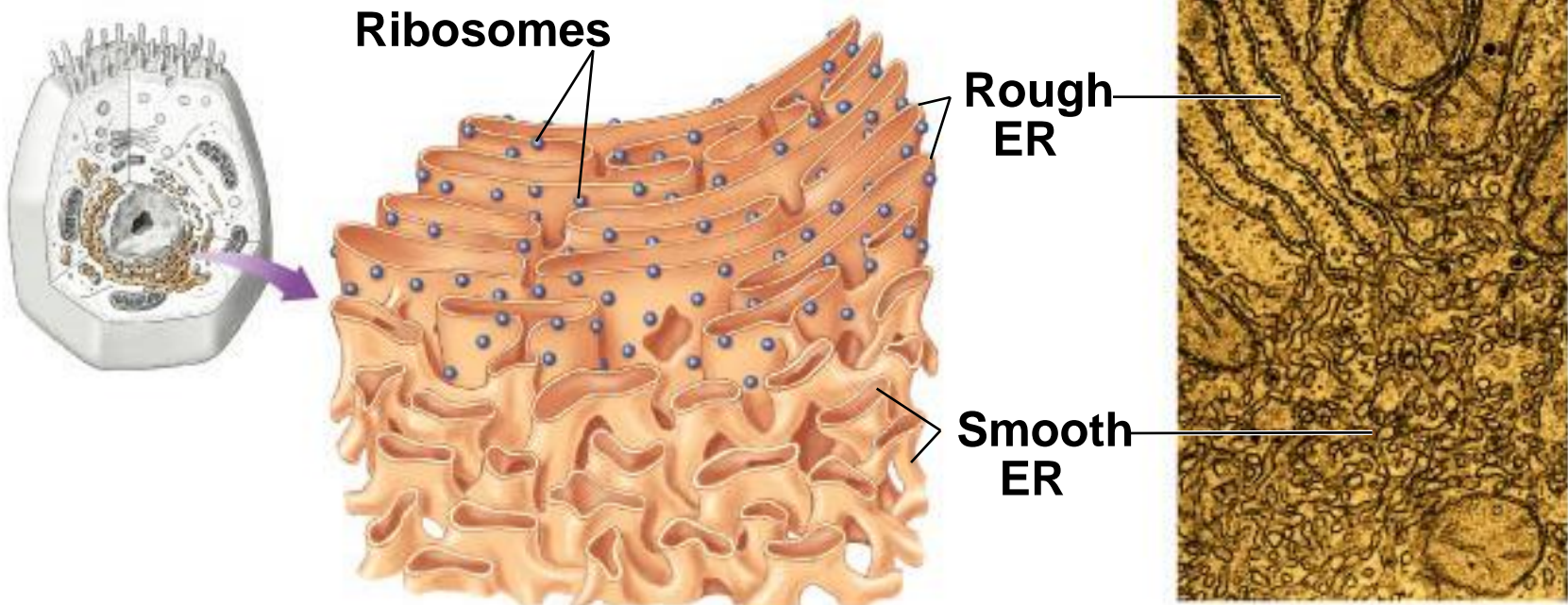


Ribosomes

- **Function**
 - ◆ protein production
- **Structure**
 - ◆ rRNA & protein
 - ◆ 2 subunits combine

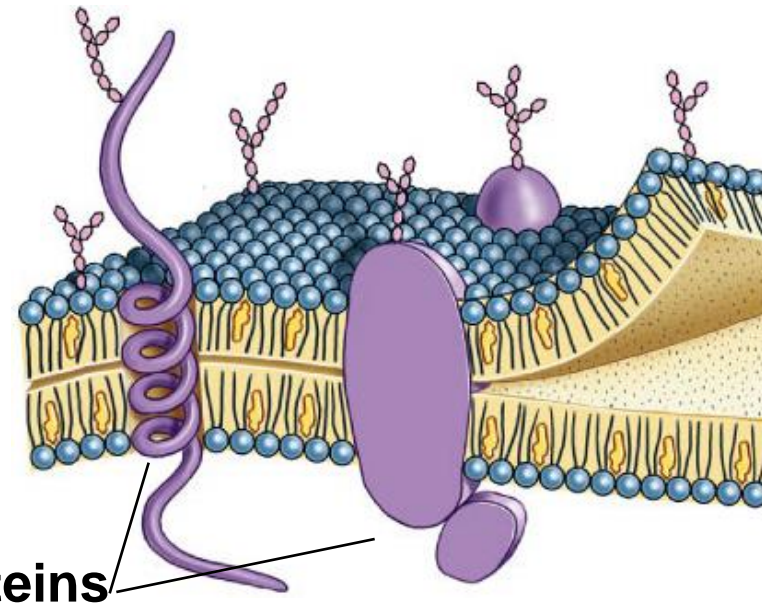
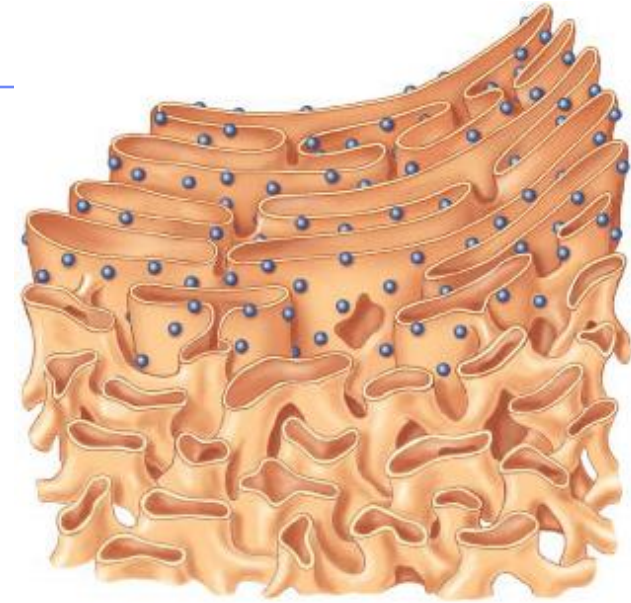


0.08 μ m



Types of Ribosomes

- **Free ribosomes**
 - ◆ suspended in cytosol
 - ◆ synthesize proteins that function in cytosol
- **Bound ribosomes**
 - ◆ attached to **endoplasmic reticulum**
 - ◆ synthesize proteins for export or for membranes



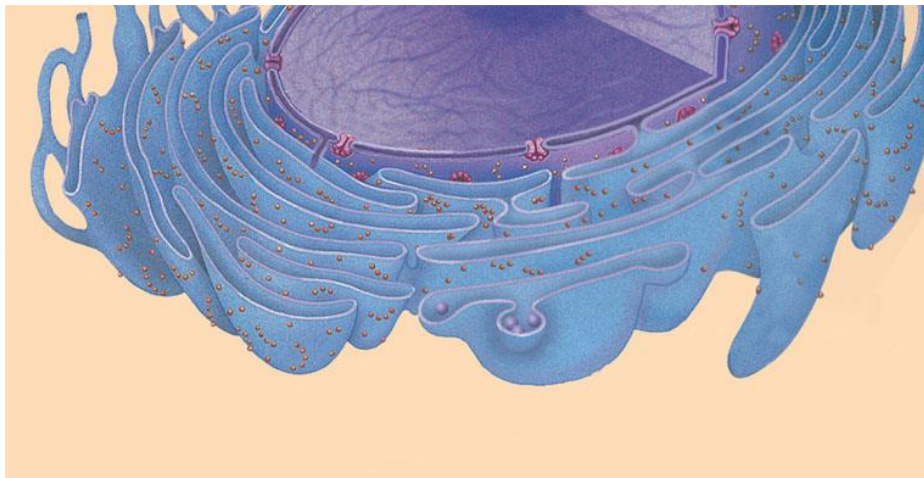
Endoplasmic Reticulum

- **Function**

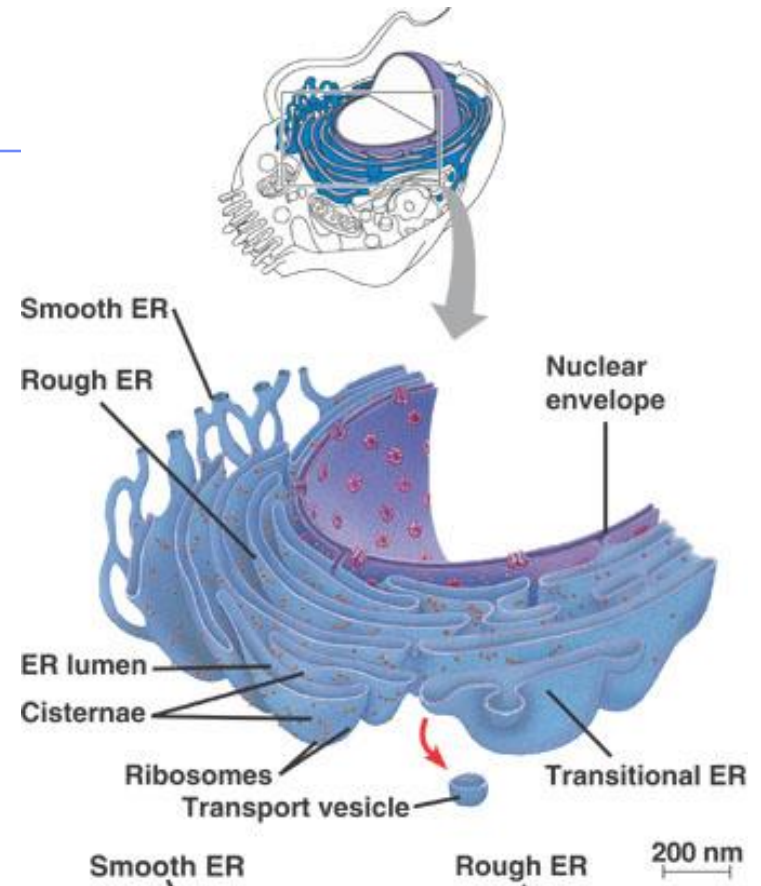
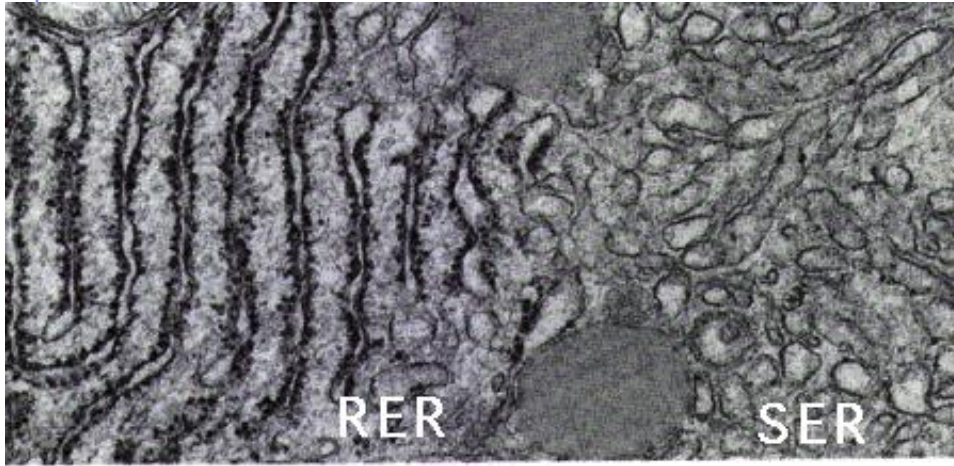
- ◆ processes proteins
- ◆ manufactures membranes
- ◆ synthesis & hydrolysis of many compounds

- **Structure**

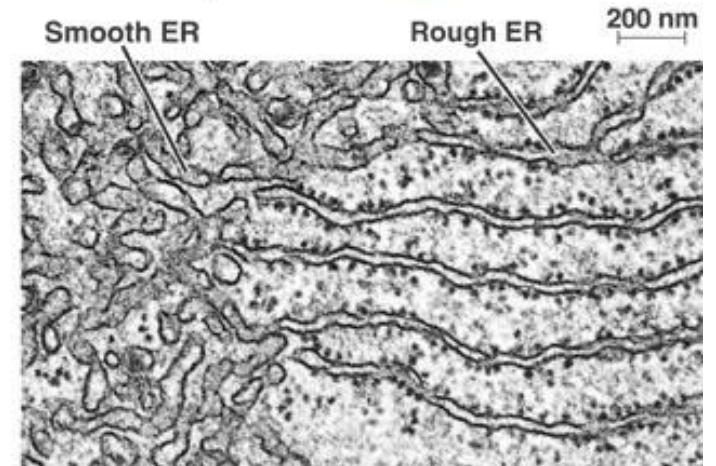
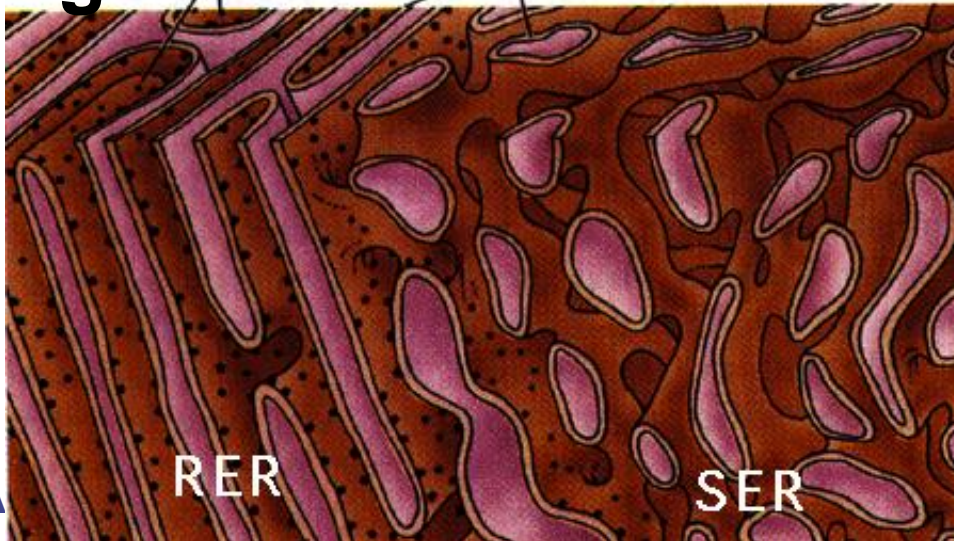
- ◆ membrane connected to nuclear envelope & extends throughout cell



Types of ER



rough Ribosomes Membranes **smooth**

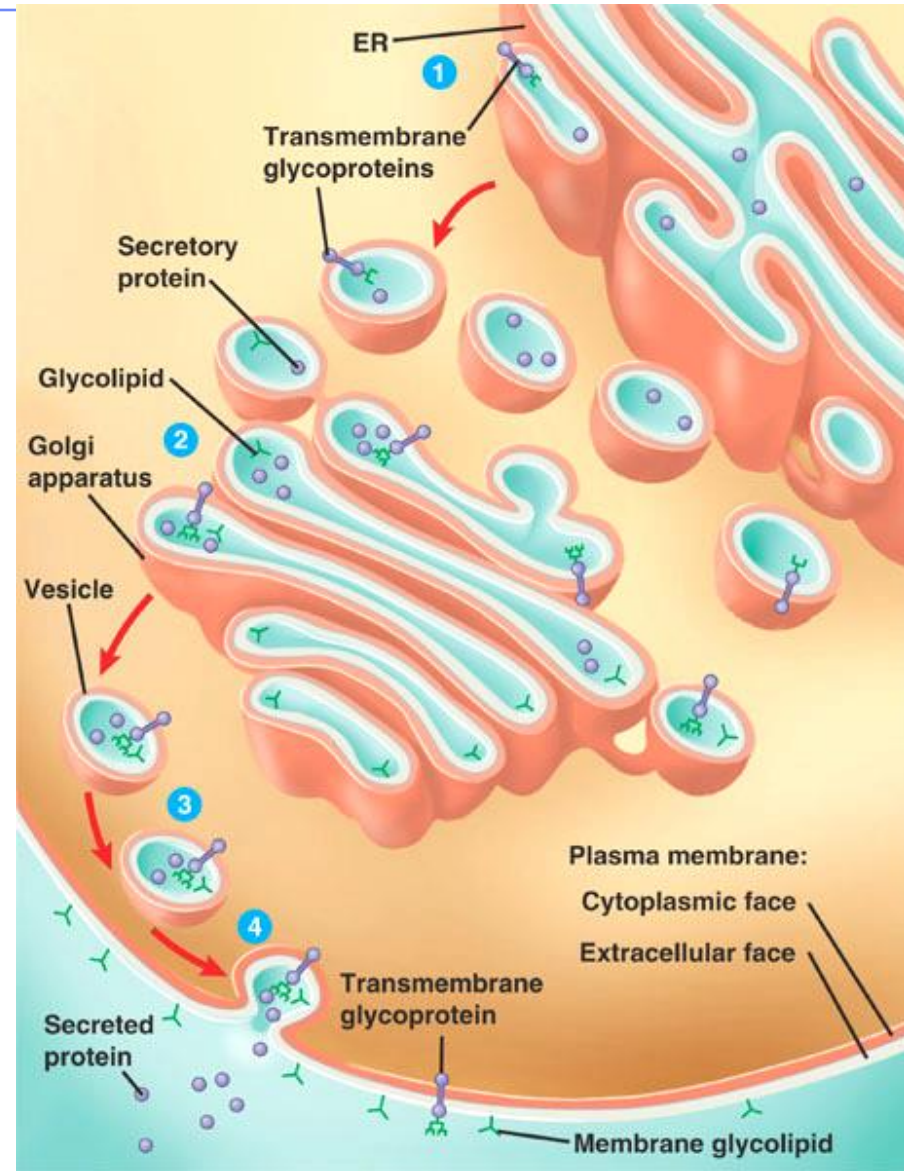


Smooth ER function

- Membrane production
- Many metabolic processes
 - ◆ synthesis
 - synthesize lipids
 - ◆ oils, phospholipids, steroids & sex hormones
 - ◆ hydrolysis
 - hydrolyze glycogen into glucose
 - ◆ in liver
 - detoxify drugs & poisons
 - ◆ in liver
 - ◆ ex. alcohol & barbiturates

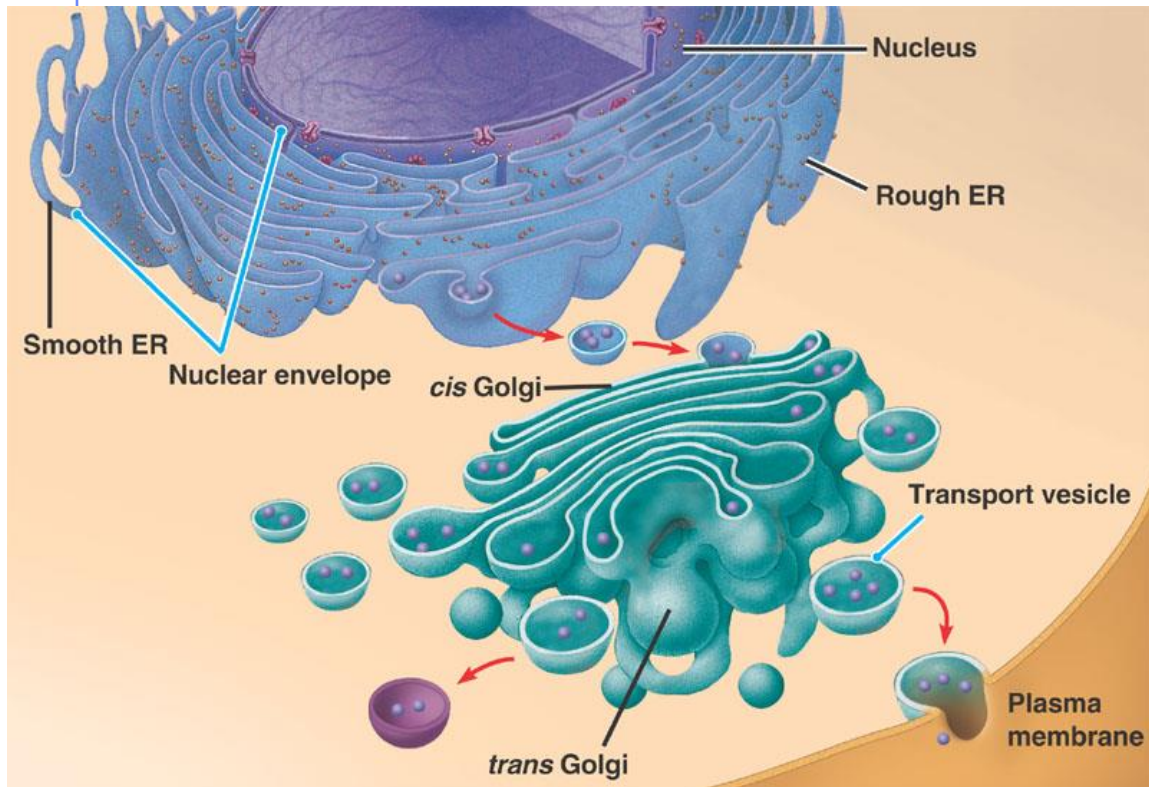
Membrane Factory

- **Build new membrane**
 - ◆ **synthesize phospholipids**
 - builds membranes
 - ◆ **ER membrane expands**
 - bud off & transfer to other parts of cell that need membranes

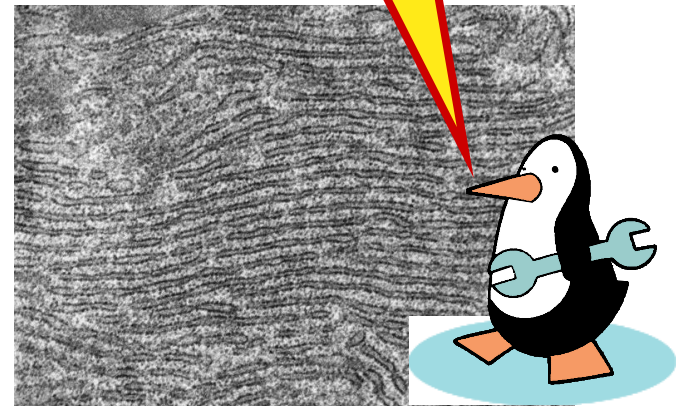


Rough ER function

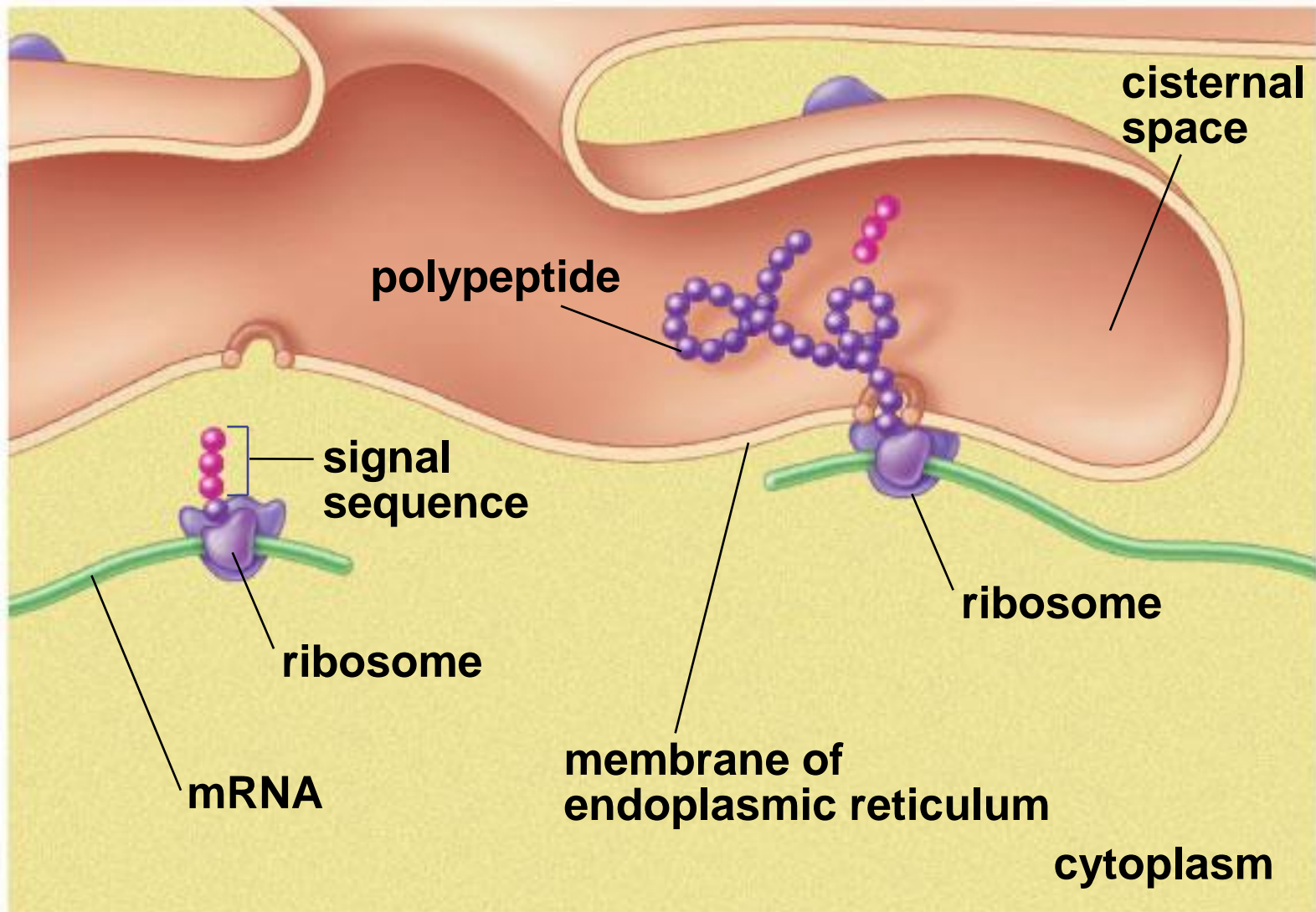
- Produce proteins for export out of cell
 - ◆ protein **secreting** cells
 - ◆ packaged into **transport vesicles** for export



Which cells have lot of rough ER?



Synthesizing proteins



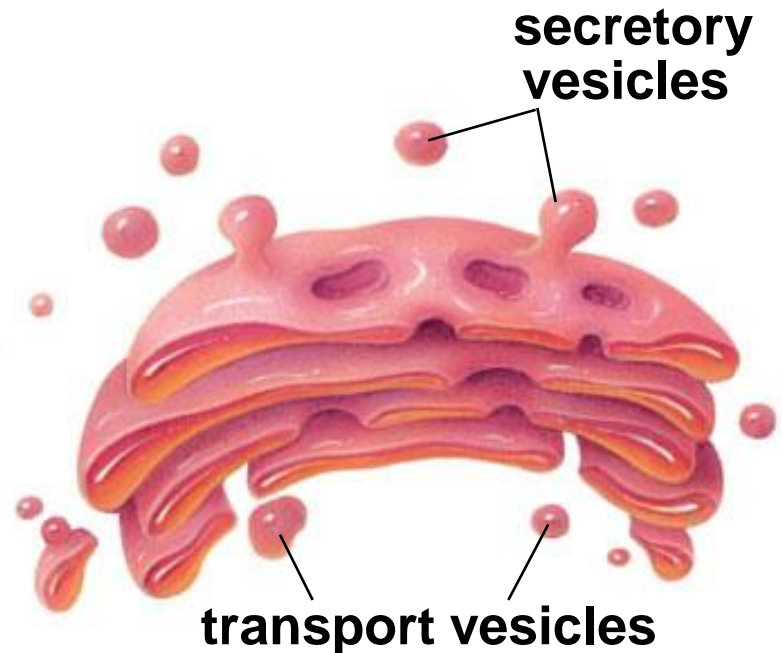
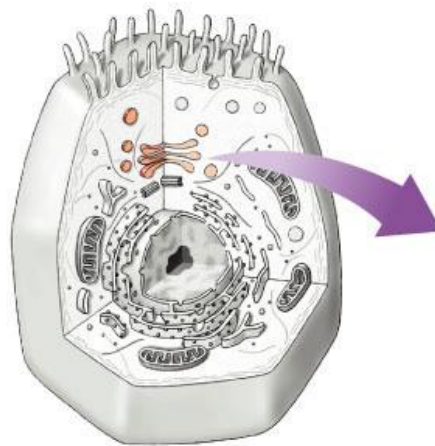


Golgi Apparatus

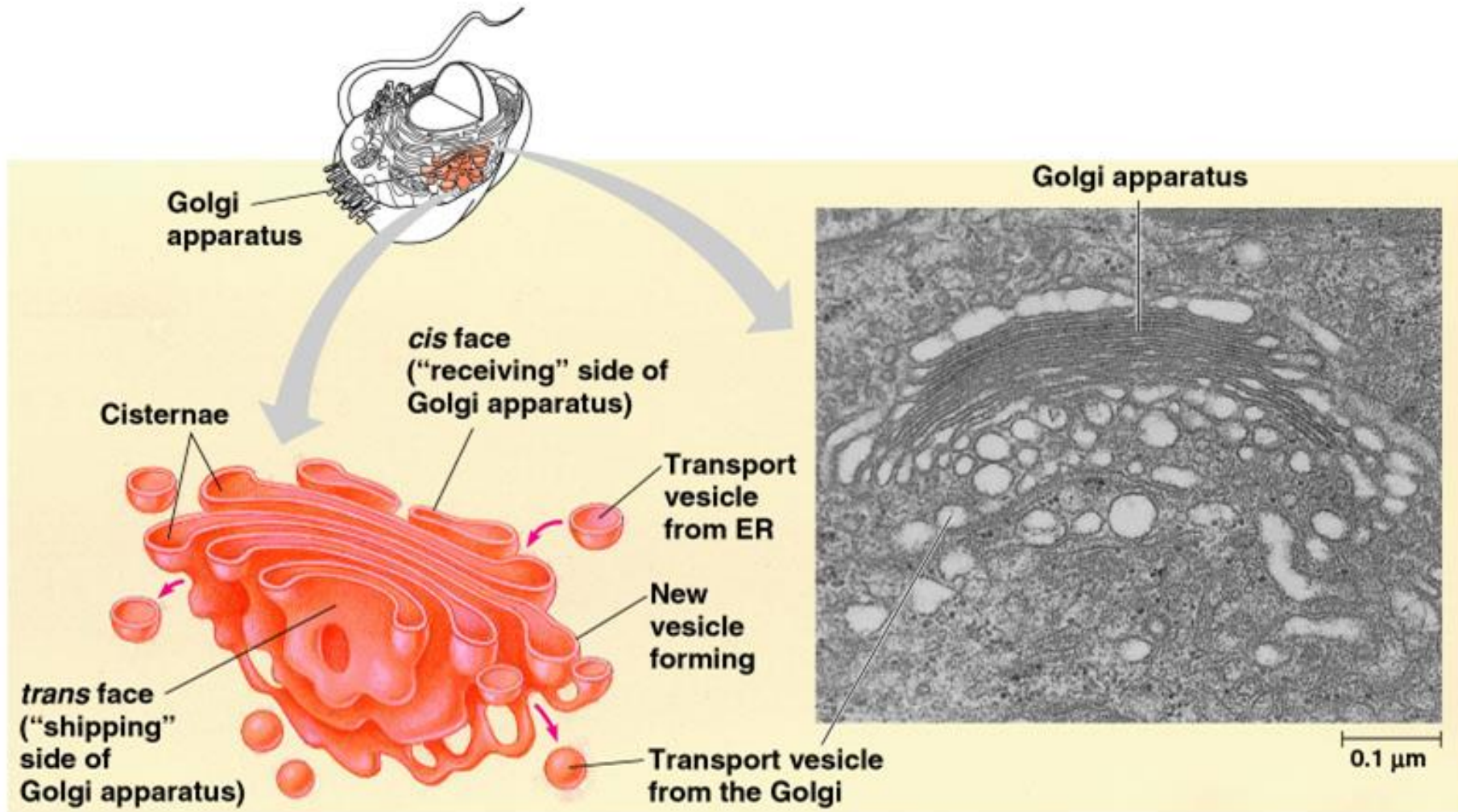
■ Function

- ◆ finishes, sorts, tags & ships cell products
 - like “UPS shipping department”
- ◆ ships products in **vesicles**
 - membrane sacs
 - “UPS trucks”

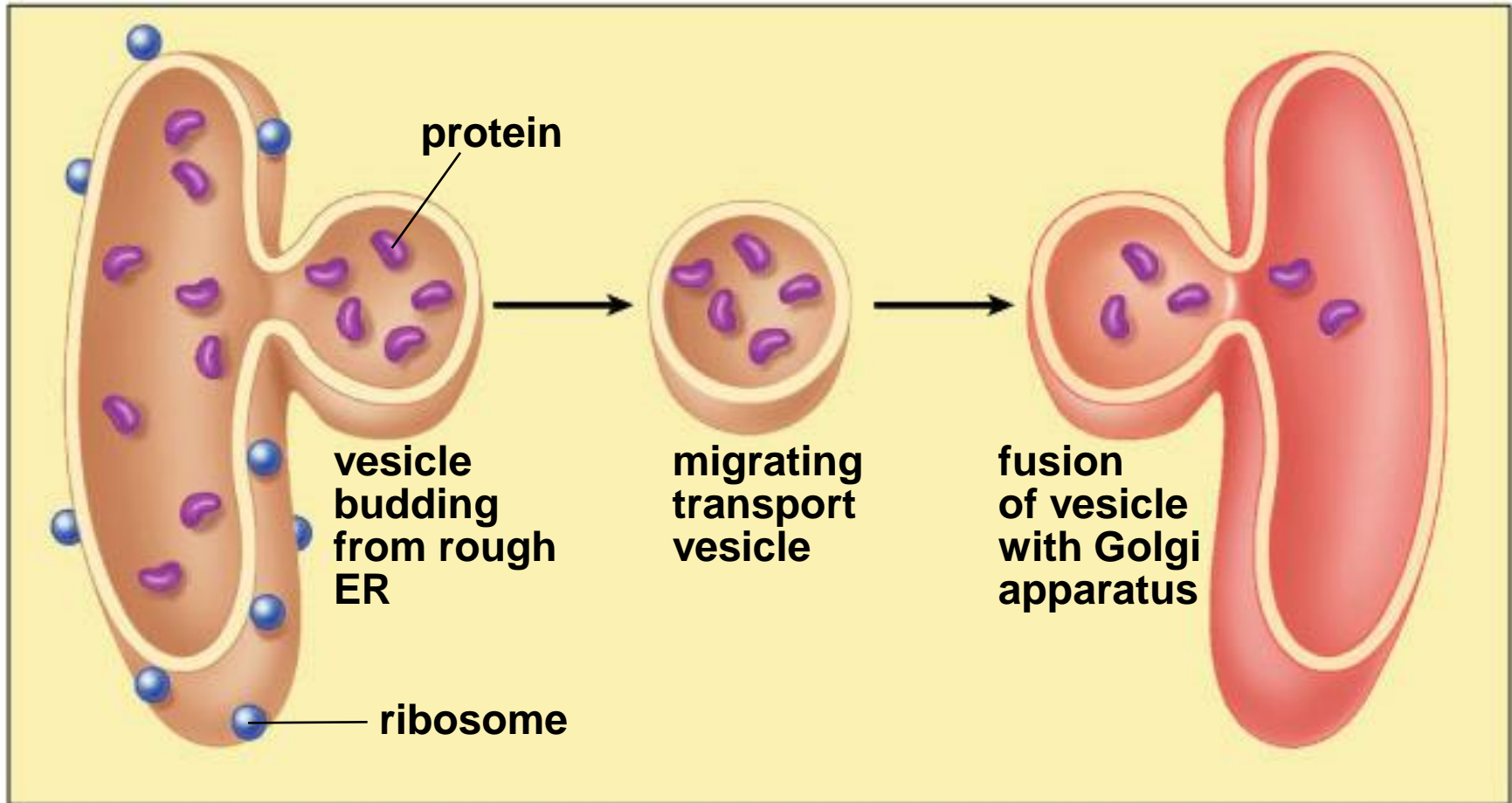
Which cells
have lots
of Golgi?

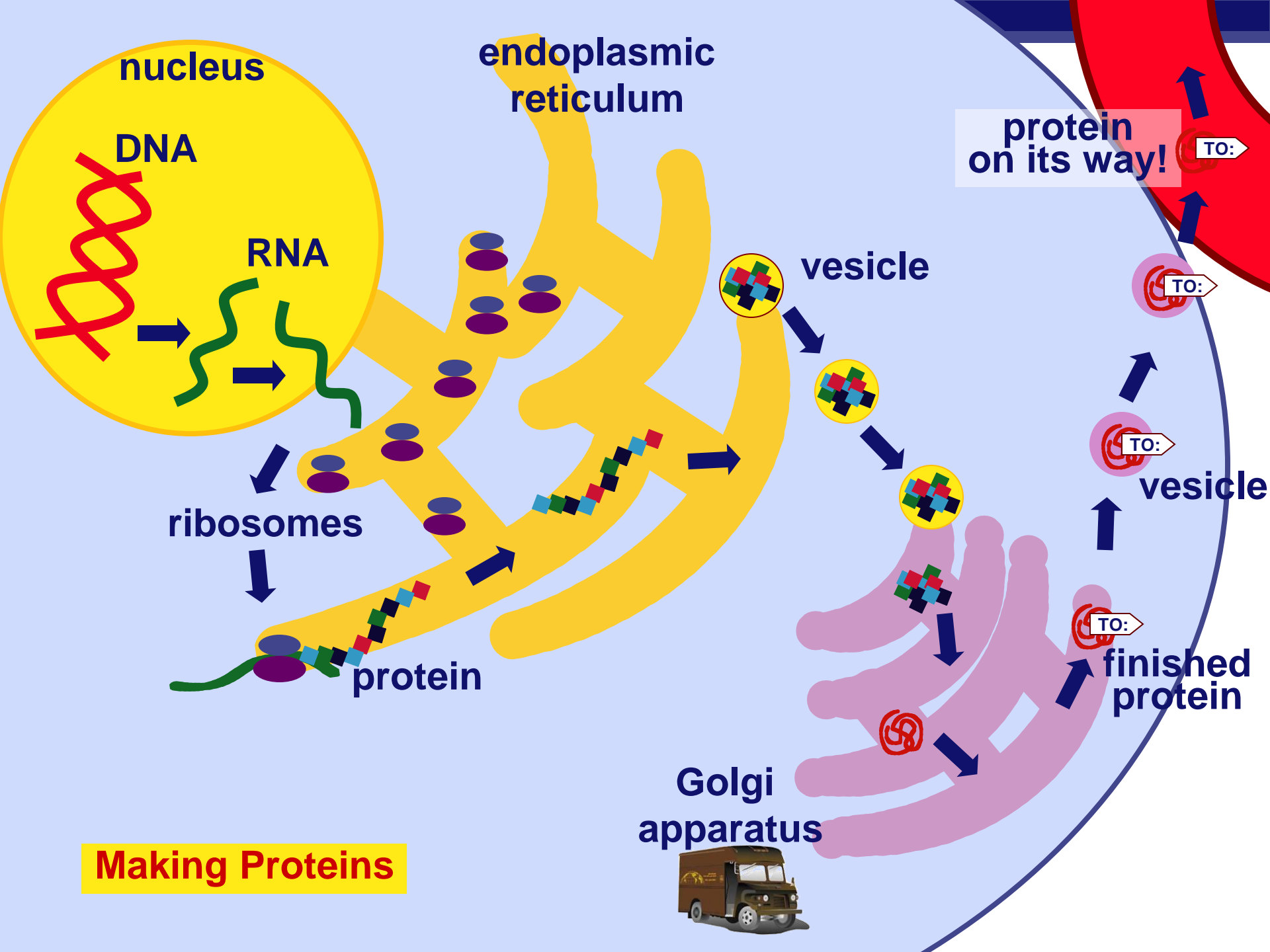


Golgi Apparatus



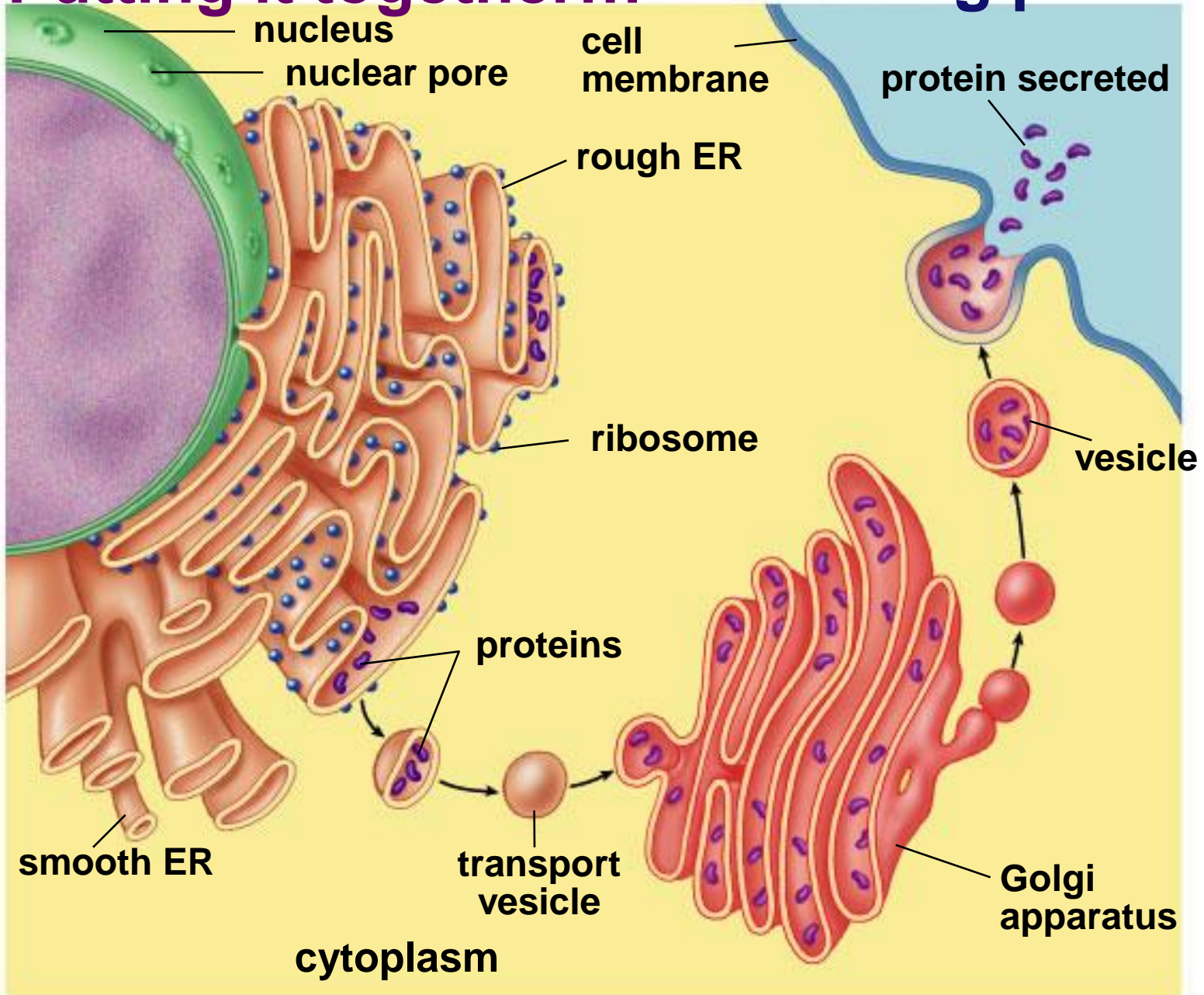
Vesicle transport

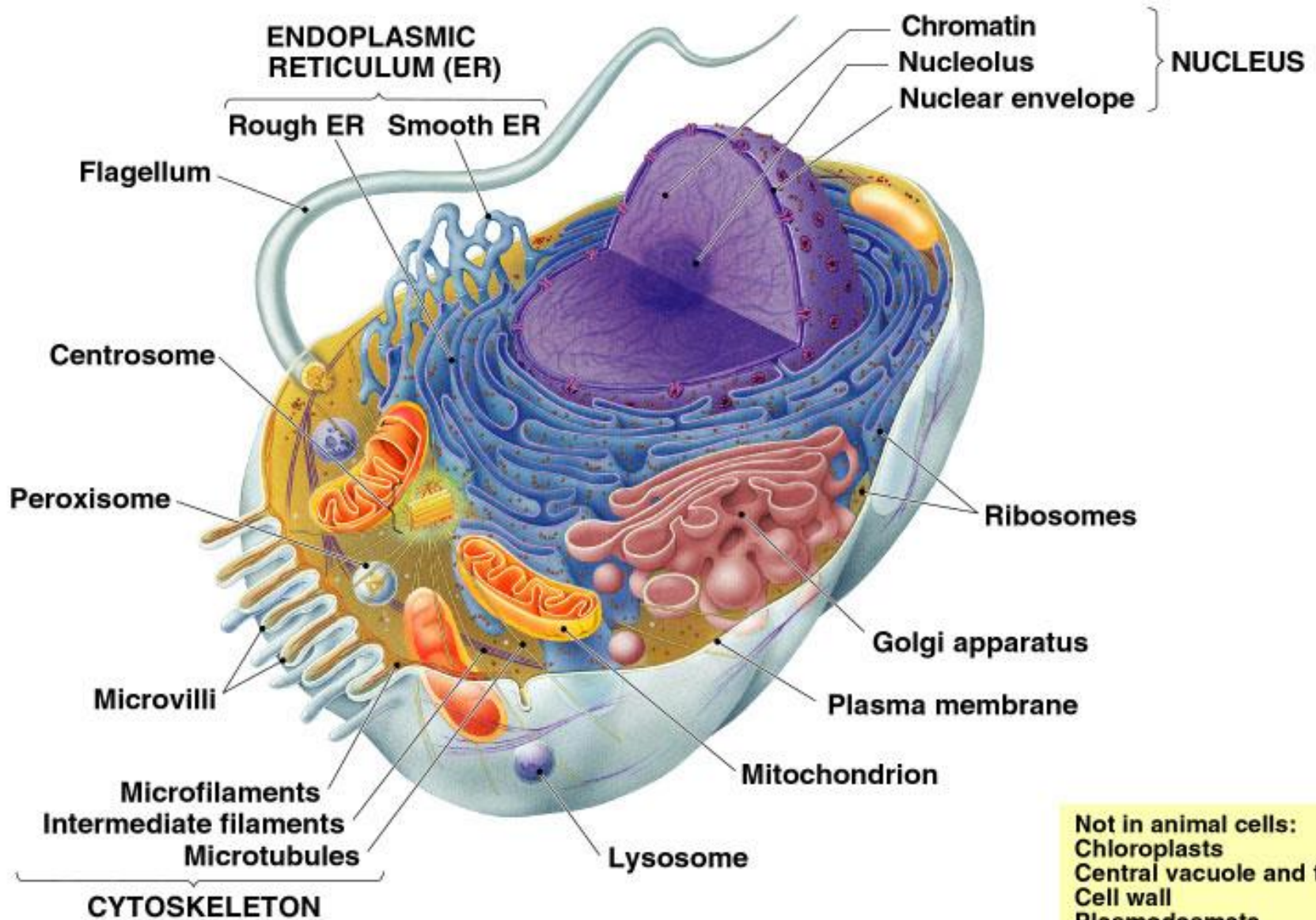




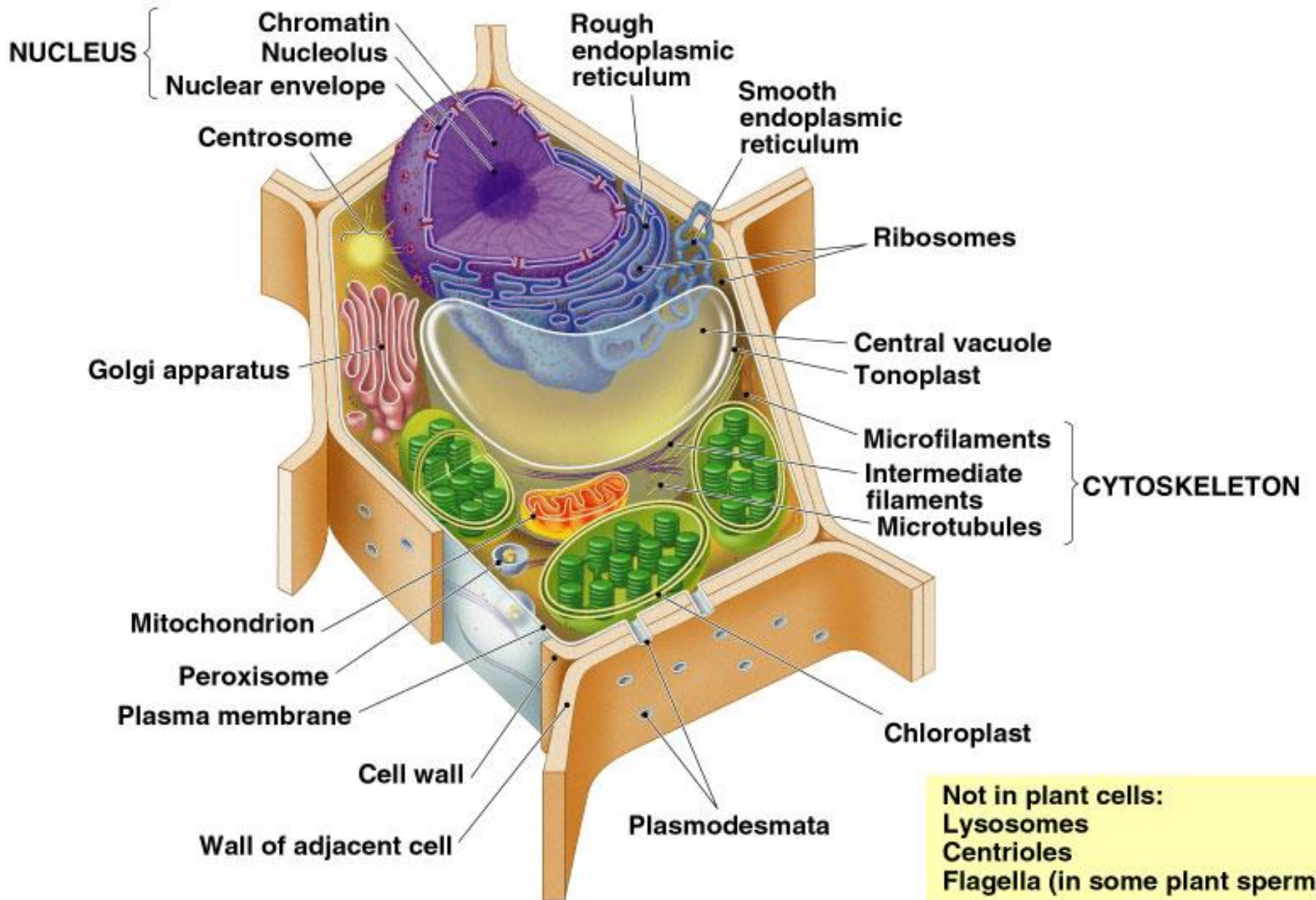
Putting it together...

Making proteins





Not in animal cells:
 Chloroplasts
 Central vacuole and tonoplast
 Cell wall
 Plasmodesmata



Any Questions!!

