**AP BIOLOGY 2021-22 September 24, 2021**

**Today’s Agenda (Day 28)**

1. Housekeeping Items

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1. Homework Check:

🡪 Chapter 5 Reading Guide

1. Class Activity:

🡪BEGIN: Chapter 6 PPT Review

1. **Section 6.1 – Biologists use microscopes and tools of biochemistry to study cells**
2. **Section 6.2 – Eukaryotic cells have internal membranes that compartmentalize their functions**
3. Section 6.3 – The eukaryotic cell’s genetic instructions are housed in the nucleus
4. Section 6.4 – The endomembrane system regulates protein traffic
5. Section 6.5 – Mitochondria and chloroplasts change energy from one form to another
6. Section 6.6 – The cytoskeleton is a network of fibers that organizes structures and activities in the cell

🡪 MONDAY: Microscope Activity

HOMEWORK:

* READ: Chapters 4 – 6
* COMPLETE: Chapter 6 Reading Guide
* STUDY: Ch 6 Test

Chapter 6 Vocabulary

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Actin | Basal body | Cell fractionation | Cell wall | Central vacuole |
| Centrioles | Centrosome | Chloroplasts | Chromatin | Chromosomes |
| Cilia | Collagen | Communicating junctions | Contractile vacuoles | Cortex |
| Cristae | Cytoplasm | Cytoplasmic streaming | Cytoskeleton | Cytosol |
| Desmosomes | Dynein | Electron microscope | Electrons | Endomembrane system |
| Endoplasmic reticulum | Endosymbiont theory | Eukaryotic cell | Extracellular matrix | Fibronectin |
| Flagella | Glycoproteins | Golgi apparatus | Granum | Integrins |
| Intermediate filaments | Light microscope | Lysosome | Microfilaments | Microtubules |
| Middle lamella | Mitochondria | Mitochondrial matrix | Motor proteins | Myosin |
| Nuclear envelope | Nuclear lamina | Nucleolus | Nucleus | Peroxisome |
| Phagocytosis | Plasma membrane | Plasmodesmata | Plastids | Primary cell wall |
| Prokaryotic cell | Proteoglycans | Pseudopodia | Ribosomes | Rough ER |
| Scanning electron microscope | Secondary cell wall | Smooth ER | Stroma | Thylakoids |
| Tight junctions | Transmission electron microscope | Transport vesicles | vacuoles |  |

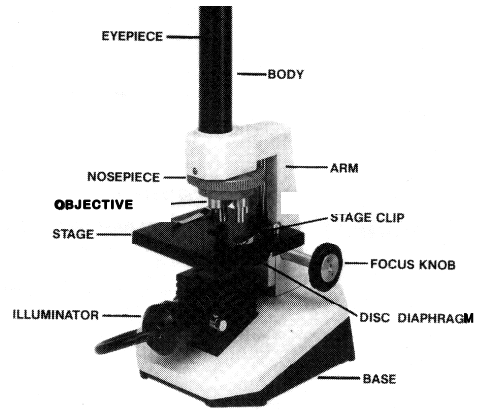
REMINDERS:

* Chapter 6 Reading Guide – Sept. 27
* TEST: Chapter 6 & 7 **🡪 Oct. 14**

**AP BIOLOGY 2021-22 ACTIVITY**

**Microscopes!**

**Introduction** The microscope was invented in the 1500’s and has been a major tool of biology ever since. By means of lenses, the microscope can magnify things too small to be seen by the naked eye. One type of microscope we have in the lab is a compound microscope. You are to learn the structures and functions of the parts of this microscope. See the diagram and descriptions below.



**Parts of a Microscope**

• **Eyepiece** magnifies the image ten times (10x). Do NOT remove it from the microscope because it will allow dirt into the body tube or you could drop and break it.

• **Body** tube keeps the eyepiece and objective lenses at standard distances.

• Low power **objectives** magnify the specimen 4x and 10x. ALWAYS START YOUR FOCUSING ON LOW POWER. Start with the 4x objective to scan the slide and then switch to the 10x objective. High power objective magnifies the object 20x on your microscopes. THE MICROSCOPE SHOULD ALWAYS BE LEFT ON LOW POWER WHEN PUTTING IT AWAY.

• **Stage** is the structure on which you place the slide. There are stage clips to hold the slide in place. The stage should be dry so you can easily move the slide to find whatever you are looking for.

• **Focus knob** is used to focus the specimen.

• **Diaphragm** is below the stage, is round and has holes. Some have more complicated structures. It allows you to adjust the amount of light coming up from the mirror. It works like the iris of your eye that controls the amount of light entering the pupil.

• **Illuminators** are built into these microscopes. The light is found under the stage to shine the light up through the specimen you are looking at

**Learn These Terms**

1. **Magnification** is the ability to enlarge an image (what you see looking through the eyepiece). The total magnification for the microscope is obtained by multiplying the magnification of the eyepiece times the magnification of the objective lens. The eyepiece on the microscope is 10x and the three objective lenses are 4x, 10x and 20x.

What is the total magnification using each of the objective lenses? 4x=\_\_\_\_\_\_\_\_ 10x=\_\_\_\_\_\_\_\_\_ 20x=\_\_\_\_\_\_\_\_\_

2. **The Field of view** is what is observed looking through the microscope. It is circular. The field of view on low power is larger than the field of view on high power.

3. **Transmitted light** is what goes through a thin specimen and is used in the compound microscope. Your specimen, therefore, has to be thin enough to allow light to go through it.

4. **Reflected light** is used in the stereo microscopes to observe large specimens. Light reflects off the surface so you can see the surface of the object, such as a flower.

**Materials**

• Slides • Plastic coverslips • Eyedroppers • Tweezers • Compound microscopes • letters from newsprint paper

**Procedure**

**Part I. Compound Microscope**:

1. Go to the table or desk where your teacher has placed the microscopes. The microscope should have been left with the low power lens in use.

2. Obtain a clean slide and coverslip. If the slide is not clean, use a paper towel and water to clean it.

3. Place a piece of newspaper under the objective lens and find a letter “e” in a word. You do not need to use a slide for this. Do not use the capital “E.” Make sure the “e” is in a normal position to your naked eye.

4. With a pencil, sketch the letter as you see it while looking through the microscope.

5. Compare how the “e” looks under the microscope to how it looks with the naked eye.

6. Switch to high power.

7. Now how does the “e” look?

8. Get a piece of colored paper. Put it on the stage without a slide and look through the microscope. Describe what you see under the microscope compared to what you see with your naked eye:

**Observe a couple of strands of pond algae, or a drop from a hay infusion.**

Take the algae from the container with a tweezers and place the strands on the slide. TAKE ONLY A COUPLE OF STRANDS or t. will look like a pile of junk under the microscope.

• Add a drop of pond water and a coverslip. You might also need to use Protoslo, if you are using hay infusion, to slow down the creatures in the drop.

• Wipe any water from under the slide with a piece of paper towel.

• Place the slide on the stage and observe under LOW POWER (4x and then 10x)

• Sketch what you see under LOW POWER

9. Switch the microscope to HIGH POWER (20X) and observe the algae very carefully. Make another sketch of what you see under HIGH POWER.

**AP BIOLOGY 2021-22 ACTIVITY**

**Microscopes: Human Cheek Cell**

1. To view cheek cells, gently scrape the inside lining of your cheek with a toothpick. DO NOT GOUGE THE INSIDE OF YOUR CHEEK!

2. Gently roll & tap the toothpick onto the center of a glass slide with a single drop of water. Some of the cheek cells will fall onto the slide.

3. Cover with a cover slip using proper procedure.

4. Observe the cheek cells under scanning, low and high power of your microscope.

5. Add a drop of methylene blue stain or iodine. This is done by placing a drop on the side of the cover slip and placing a paper towel on the opposite edge of the coverslip. This should draw the stain through and color the cells.

6. Observe the cheek cells under low and high power of your microscope (at the minimum you should observe the cell membrane, nucleus, and cytoplasm).

Chart

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**AP BIOLOGY 2021-22 READING GUIDE**

# Chapter 6: A Tour of the Cell

## Concept 6.1 To study cells, biologists use microscopes and the tools of biochemistry

1. The study of cells has been limited by their small size, and so they were not seen and described until 1665, when Robert Hooke first looked at dead cells from an oak tree. His contemporary, Anton van Leeuwenhoek, crafted lenses; and with the improvements in optical aids, a new world was opened. *Magnification* and *resolving power* limit what can be seen. Explain the difference.

1. The development of electron microscopes has further opened our window on the cell and its organelles. What is considered a major disadvantage of the electron microscopes?

1. Study the electron micrographs in your text. Describe the different types of images obtained from:

**scanning electron microscopy (SEM)**

## transmission electron microscopy (TEM)

4. In *cell fractionation*, whole cells are broken up in a blender, and this slurry is centrifuged several times. Each time, smaller and smaller cell parts are isolated. This will isolate different organelles and allow study of their biochemical activities. Which organelles are the smallest ones isolated in this procedure?

### **Concept 6.2 Eukaryotic cells have internal membranes that compartmentalize their functions**

1. Which two domains consist of prokaryotic cells?

1. A major difference between prokaryotic and eukaryotic cells is the location of their DNA. Describe this difference.
2. A picture containing tool

   Description automatically generatedOn the sketch of a prokaryotic cell, label each of these features and give its function or description.

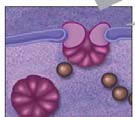
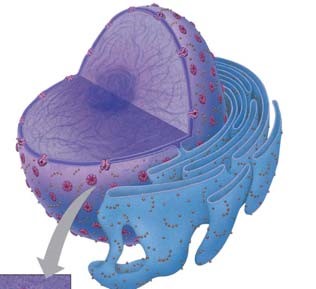
*cell wall plasma membrane bacterial chromosome nucleoid cytoplasm flagella*

1. Why are cells so small? Explain the relationship of surface area to volume.
2. Describe how many neurons and intestinal cells each have greatly increased surface area.

### **Concept 6.3 The eukaryotic cell’s genetic instructions are housed in the nucleus and carried out by the ribosomes**

1. In the figure below, label the nuclear envelope, nuclear pores, and pore complex.

1. Describe the nuclear envelope. How many layers is it? What connects the layers?



1. What is the *nuclear lamina*? *Nuclear matrix*?

1. Found within the nucleus are the *chromosomes*. They are made of *chromatin*. What are the two components of chromatin? When do the thin chromatin fibers condense to become distinct chromosomes?

1. When are the *nucleoli* visible?What are assembled here?

1. What is the function of *ribosomes*? What are their two components?

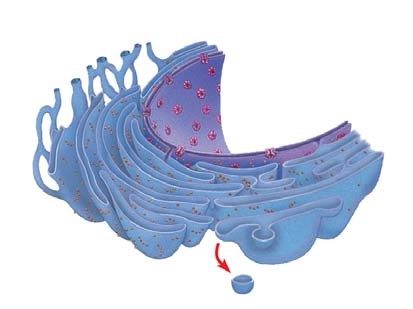
1. Ribosomes in any type of organism are all the same, but we distinguish between two types of ribosomes based on where they are found, and the destination of the protein product made. Complete this chart to demonstrate this concept.

|  |  |  |
| --- | --- | --- |
| **Type of Ribosome** | **Location** | **Product** |
| *Free ribosomes* |  |  |
| *Bound ribosomes* |  |  |

### **Concept 6.4 The endomembrane system regulates protein traffic and performs metabolic functions in the cell**

1. List all the structures of the endomembrane system.

1. The *endoplasmic reticulum (ER)* makes up more than half the total membrane system in many eukaryotic cells. Use this sketch to explain the ***lumen***, ***transport vesicles***, and the difference between ***smooth* and *rough ER***.



1. List and describe three major functions of the smooth ER.

1. Why does alcohol abuse increase tolerance to other drugs such as barbiturates?

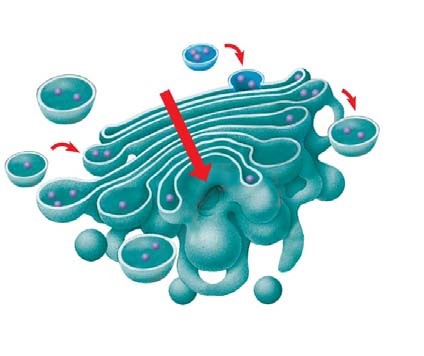
1. The rough ER is studded with ribosomes. As proteins are synthesized, they are threaded into the lumen of the rough ER. Some of these proteins have carbohydrates attached to them in the ER to form *glycoproteins*. What does the ER then do with these secretory proteins?

1. Besides packaging secretory proteins into transport vesicles, what is another major function of the rough ER?

1. The transport vesicles formed from the rough ER fuse with the Golgi apparatus.

Use this sketch to label the *cisterna* of the Golgi apparatus, and its *cis* and *trans* faces.

Describe what happens to a transport vesicle and its contents when it arrives at the Golgi.



1. What is a ***lysosome***? What do they contain? What is their pH?

1. One function of lysosomes is intracellular digestion of particles engulfed by *phagocytosis*.

Describe this process of digestion. What human cells carry out phagocytosis?

1. A second function of lysosomes is to recycle cellular components in a process called *autophagy*. Describe this process.

1. What happens in Tay-Sachs disease? Explain the role of the lysosomes in Tay-Sachs.

1. There are many types of vacuoles. Briefly describe:

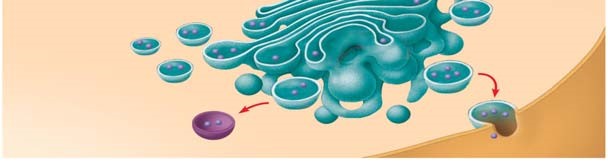
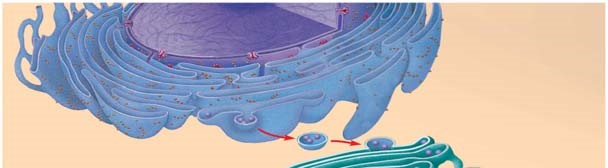
**food vacuoles**

**contractile vacuoles**

## central vacuoles in plants

(give at least three functions/materials stored here)

29. Use this figure to explain how the elements of the endomembrane system function together to secrete a protein and to digest a cellular component. Label as you explain.



### **Concept 6.5 Mitochondria and chloroplasts change energy from one form to another**

1. Mitochondria and chloroplasts are not considered part of the endomembrane system, although they are enclosed by membranes. Sketch a mitochondrion here and label its ***outer******membrane***, ***inner membrane***, ***inner membrane space***, ***cristae***, ***matrix***, and ***ribosomes***.

1. Now sketch a chloroplast and label its ***outer membrane***, ***inner membrane***, ***inner membrane space***, ***thylakoids***, ***granum***, and ***stroma***. Notice that the mitochondrion had two membrane compartments, while the chloroplast has three compartments.

1. What is the function of the mitochondria?

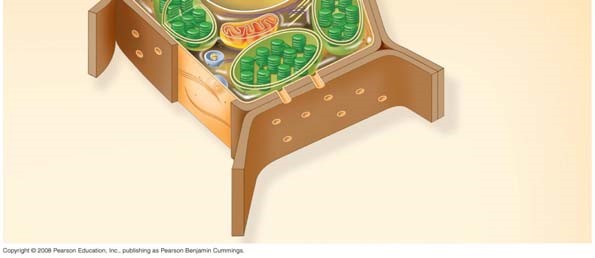
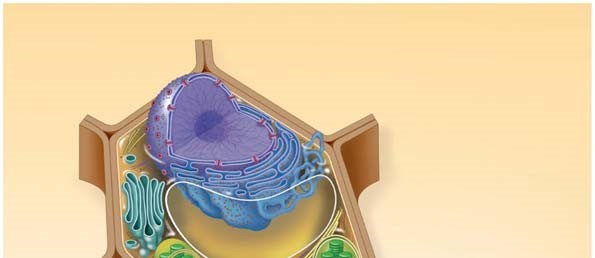
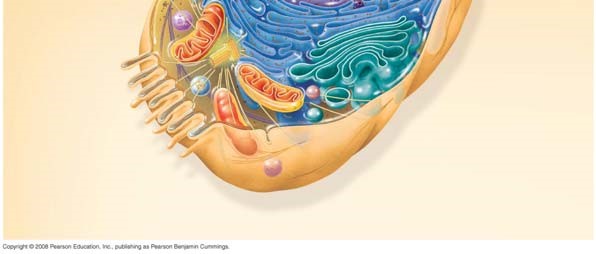
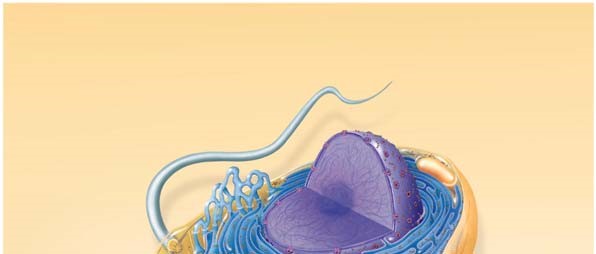
1. What is the function of the chloroplasts?

1. Recall the relationship of structure to function. Why is the inner membrane of the mitochondria highly folded? What role do all the individual thylakoid membranes serve? (Same answer for both questions.) Chloroplasts and mitochondria both have ribosomes and their own DNA. You will learn later about their evolution, but for now hold onto these facts. They are semiautonomous organelles that grow and reproduce within the cell. And you’re lucky today— there is not a question here!

1. Explain the important role played by ***peroxisomes***.

## SUMMARY

On these diagrams of plant and animal cells, label *each* organelle and give a brief statement of its function.



### **Concept 6.6 The cytoskeleton is a network of fibers that organizes structures and activities in the cell**

1. What is the ***cytoskeleton***?

1. What are the three roles of the cytoskeleton?

1. There are three main types of fibers that make up the cytoskeleton. Name them.

1. ***Microtubules*** are hollow rods made of a globular protein called tubulin. Each tubulin protein is a dimer made of two subunits. These are easily assembled and disassembled. What are four functions of microtubules?

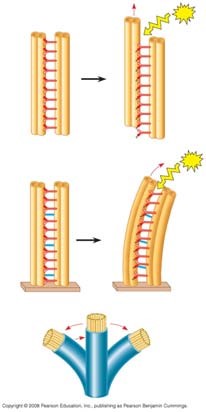
1. Animal cells have a ***centrosome*** that contains a pair of ***centrioles***. Plant cells do not have centrioles. What is another name for centrosomes? What is believed to be the role of centrioles?

1. Describe the organization of microtubules in a centriole. Make a sketch here that shows this arrangement in cross section.

1. ***Cilia*** and ***flagella*** are also composed of microtubules. The arrangement of microtubules is said to be “9 + 2.” Make a sketch of a cross section here.

1. *Compare and contrast* cilia and flagella. (This is a specific instruction that means you are to tell how they are alike—compare—and tell how they are different—contrast. Remember this hint when you see a similar phrase on an exam.)

1. How do motor proteins called ***dyneins*** cause movement of cilia? What is the role of ATP in this movement? This figure might help you explain.



1. **Microfilaments** are solid, and they are built from a double chain of ***actin***. What are four functions of microfilaments? What are the motor proteins that move the microfilaments?
2. **Intermediate filaments**are bigger than microfilaments but smaller than microtubules. They are more permanent fixtures of cells. Give two functions of intermediate filaments.

### **Concept 6.7 Extracellular components and connections between cells help coordinate cellular activities**

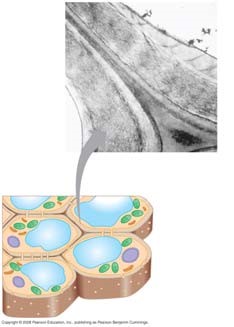
47 What are three functions of the *cell wall*?

1. What is the composition of the cell wall?

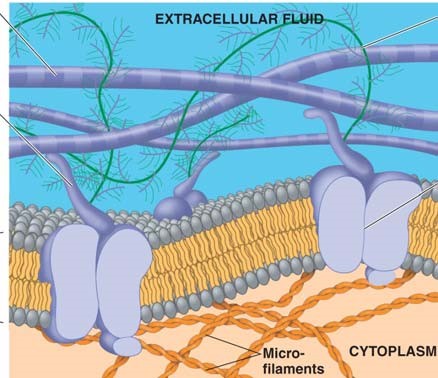
1. What is the relatively thin and flexible wall secreted first by a plant cell?

1. What is the ***middle lamella***? Where is it found? What material is it made of?
2. Explain the deposition of a ***secondary cell wall***.

1. On the sketch, label the ***primary cell wall***, ***secondary cell wall***, ***middle lamella***, ***cytosol***, ***plasma membrane***, ***central vacuole***, and ***plasmodesmata***.

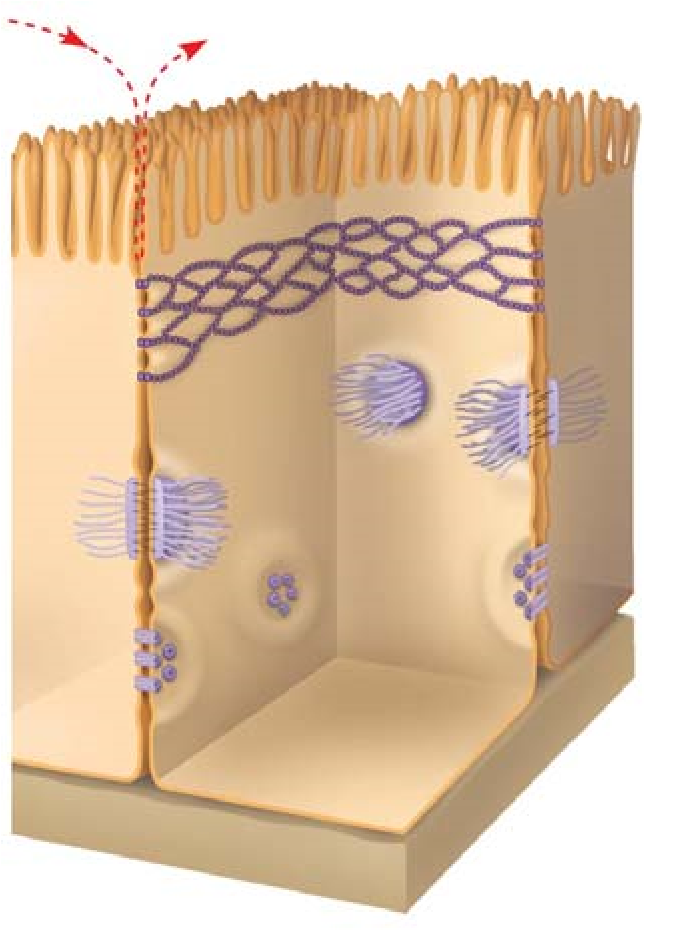


1. Animal cells do not have cell walls, but they do have an extracellular matrix (ECM). On this figure, label the elements indicated, and give the role of each.

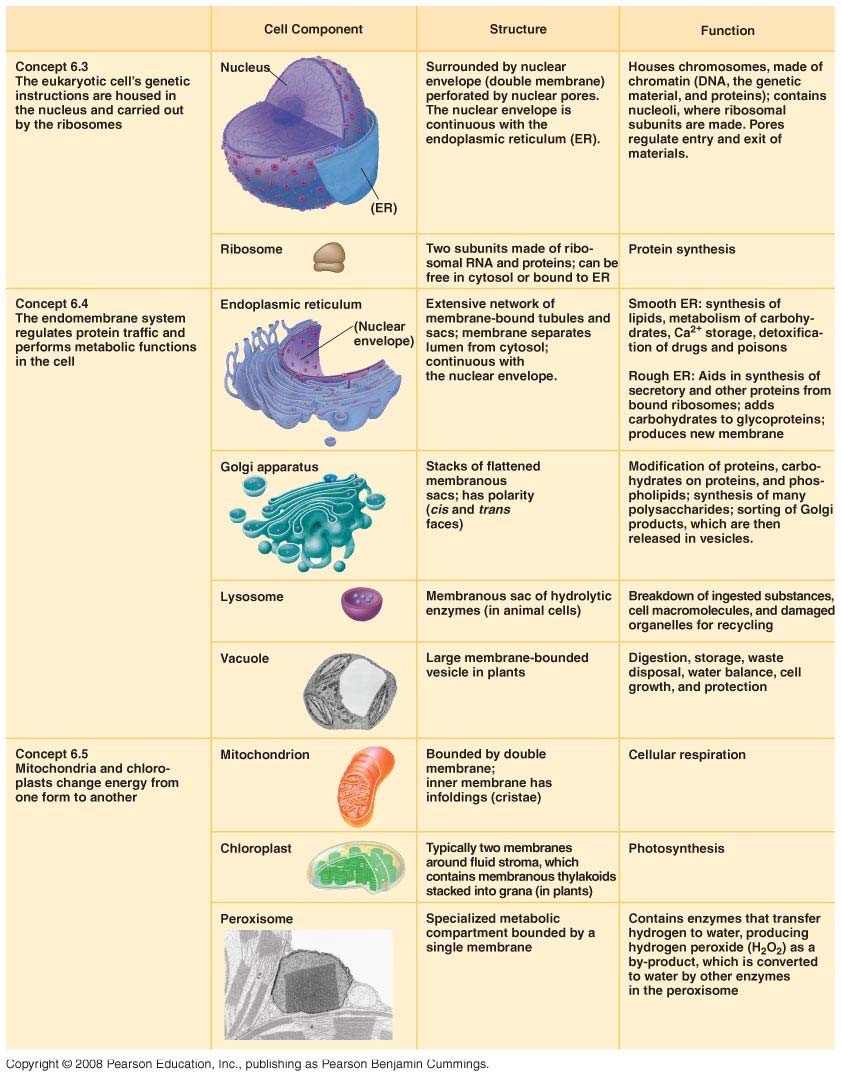


1. What are the **intercellular junctions** between plant cells? What can pass through them?

1. Animals cells do not have ***plasmodesmata***. This figure shows the three types of intercellular junctions seen in animal cells. Label each type and summarize its role.



Here’s a great chart to summarize three concepts—study it!



**Testing Your Knowledge: Self-Quiz Answers**

Now you should be ready to test your knowledge. Place your answers here: