Preview

Concept Mapping

End Of Slide

Bellringer

Why do you think cells weren't discovered until 1665? What invention do you think made their discovery possible? Do you think people can ever see cells with the naked eye? Explain your answer.

Write your responses in your **science journal.**

Objectives

- **State** the parts of the cell theory.
- **Explain** why cells are so small.
- **Describe** the parts of a cell.

End Of Slide

Objectives, *continued*

- **Describe** how eubacteria are different from archaebacteria.
- **Explain** the difference between prokaryotic cells and eukaryotic cells.

Cells and the Cell Theory

- In 1665, Robert Hooke was the first person to describe cells when looking at cork with a microscope.

- Hooke observed cells in plants and fungi.

- **Finding Cells in Other Organisms** In 1673, Anton von Leeuwenhoek discovered single-celled organisms (protists) in pond scum. Leeuwenhoek was also the first to see blood cells, bacterial cells, and yeast cells.

End Of Slide

Cells and the Cell Theory, *continued*

- In 1838, Matthias Schleiden concluded that all plant parts were made of cells.
- In 1839, Theodor Schwann concluded that all animal tissues were made of cells.
- In 1858, Rudolf Virchow stated that all cells could form only from other cells.
- These three discoveries led to the cell theory.

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Cells and the Cell Theory, *continued*

The Cell Theory states:

- All organisms are made of one or more cells.
- The cell is the basic unit of all living things.
- All cells come from existing cells.

Cell Size

- Most cells are too small to be seen without a microscope.

- **A Few Large Cells** The yolk of a chicken egg is one big cell. It can be large because it does not need to take in nutrients.

- **Many Small Cells** Most cells are small because food and waste must pass through the cell surface.

End Of Slide

Cell Size, *continued*

- As a cell's volume increases, its surface area grows. But volume increases faster than the surface area.

- The area of a cell's surface–compared with the cell's volume–limits the cell's size.

- The ratio of the cell's outer surface to the cell's volume is called the *surface area-to-volume ratio*:

$$surface\ area\text{-}to\text{-}volume\ ratio = \frac{surface\ area}{volume}$$

End of Slide

MATH FOCUS

Surface Area–to-Volume Ratio Calculate the surface area–to-volume ratio of a cube whose sides measure 2 cm.

Step 1: Calculate the surface area.

$$\textit{surface area of cube} = \textit{number of sides} \times \textit{area of side}$$

$$\textit{surface area of cube} = 6 \times (2\text{ cm} \times 2\text{ cm})$$

$$\textit{surface area of cube} = 24\text{ cm}^2$$

Step 2: Calculate the volume.

$$\textit{volume of cube} = \textit{side} \times \textit{side} \times \textit{side}$$

$$\textit{volume of cube} = 2\text{ cm} \times 2\text{ cm} \times 2\text{ cm}$$

$$\textit{volume of cube} = 8\text{ cm}^3$$

Step 3: Calculate the surface area–to-volume ratio.

$$\textit{surface area–to-volume ratio} = \frac{\textit{surface area}}{\textit{volume}} = \frac{24}{8} = \frac{3}{1}$$

Now It's Your Turn

1. Calculate the surface area–to-volume ratio of a cube whose sides are 3 cm long.
2. Calculate the surface area–to-volume ratio of a cube whose sides are 4 cm long.
3. Of the cubes from questions 1 and 2, which has the greater surface area–to-volume ratio?
4. What is the relationship between the length of a side and the surface area–to-volume ratio of a cell?

Parts of a Cell

• **The Cell Membrane and Cytoplasm** All cells are surrounded by a cell membrane. The **cell membrane** is a protective layer that covers the cell's surface and acts as a barrier.

• Inside the cell is a fluid. This fluid and almost all of its contents are called *cytoplasm*.

Parts of a Cell, *continued*

- **Organelles** are structures that perform specific functions within the cell.

- **Genetic Material** All cells contain DNA at some point in their life. DNA is genetic material that carries information needed to make new cells and new organisms.

- In some cells, the DNA is enclosed inside an organelle called the **nucleus.**

End Of Slide

Two Kinds of Cells

- Cells with no nucleus are prokaryotic.
- Cells that have a nucleus are eukaryotic.

Prokaryotes: Eubacteria and Archaebacteria

- **Prokaryotes** are single-celled organisms that do not have a nucleus or membrane-bound organelles.

- The two types of prokaryotes are eubacteria and archaebacteria.

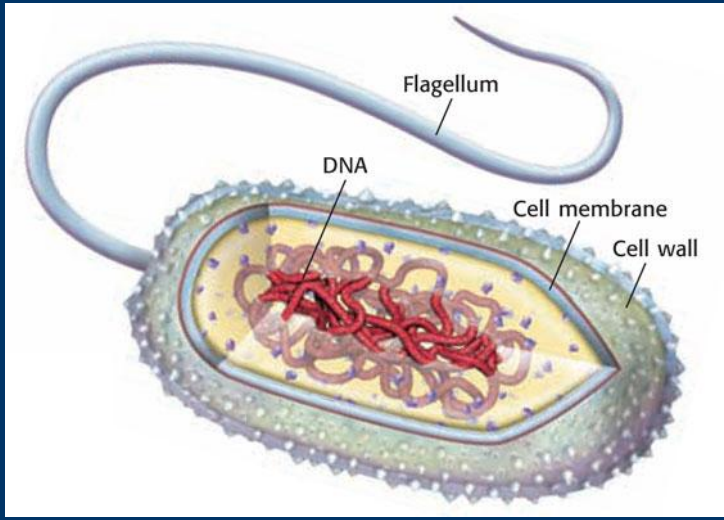
Prokaryotes: Eubacteria and Archaebacteria, *continued*

- **Eubacteria** are also called *bacteria* and are the world's smallest cells. They do not have membrane covered organelles, but they do have tiny, round organelles called *ribosomes*.

- Some bacteria live in soil and water. Others live in, or on, other organisms.

Prokaryotes: Eubacteria and Archaebacteria, *continued*

• The image below shows the DNA, cell membrane, and cell wall of a typical bacterial cell. The flagellum helps the bacterium move.



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Prokaryotes: Eubacteria and Archaebacteria, *continued*

- **Archaebacteria** are similar to bacteria in some ways and are similar to eukaryotic cells in other ways.

- Three types of archaebacteria are *heat-loving, salt-loving,* and *methane-making*. Heat-loving and salt-loving archaebacteria live in extreme conditions and are sometimes called *extremophiles*.

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Eukaryotic Cells and Eukaryotes

• Eukaryotic cells have a nucleus and other membrane-bound organelles. Most eukaryotic cells are microscopic, but are about 10 times larger than bacterial cells.

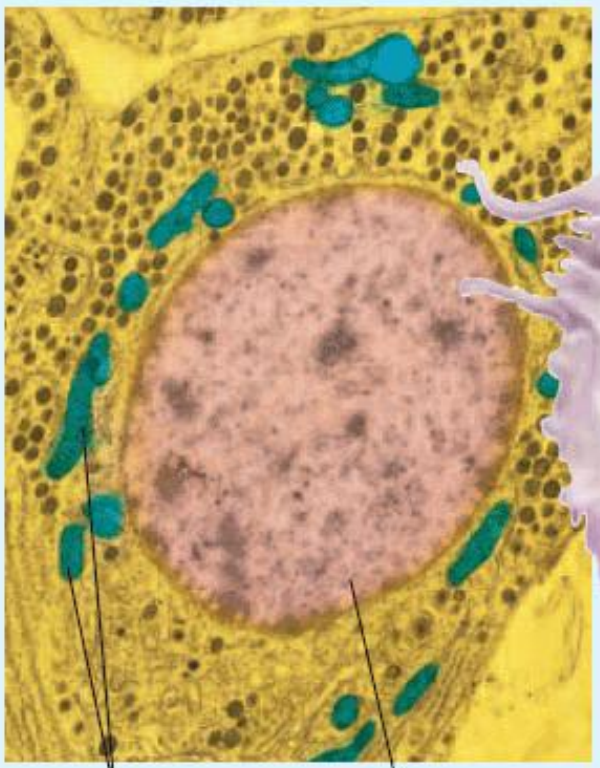
• All living things that are not bacteria or archaea are made of one or more eukaryotic cells. Organisms made of eukaryotic cells are called **eukaryotes.**

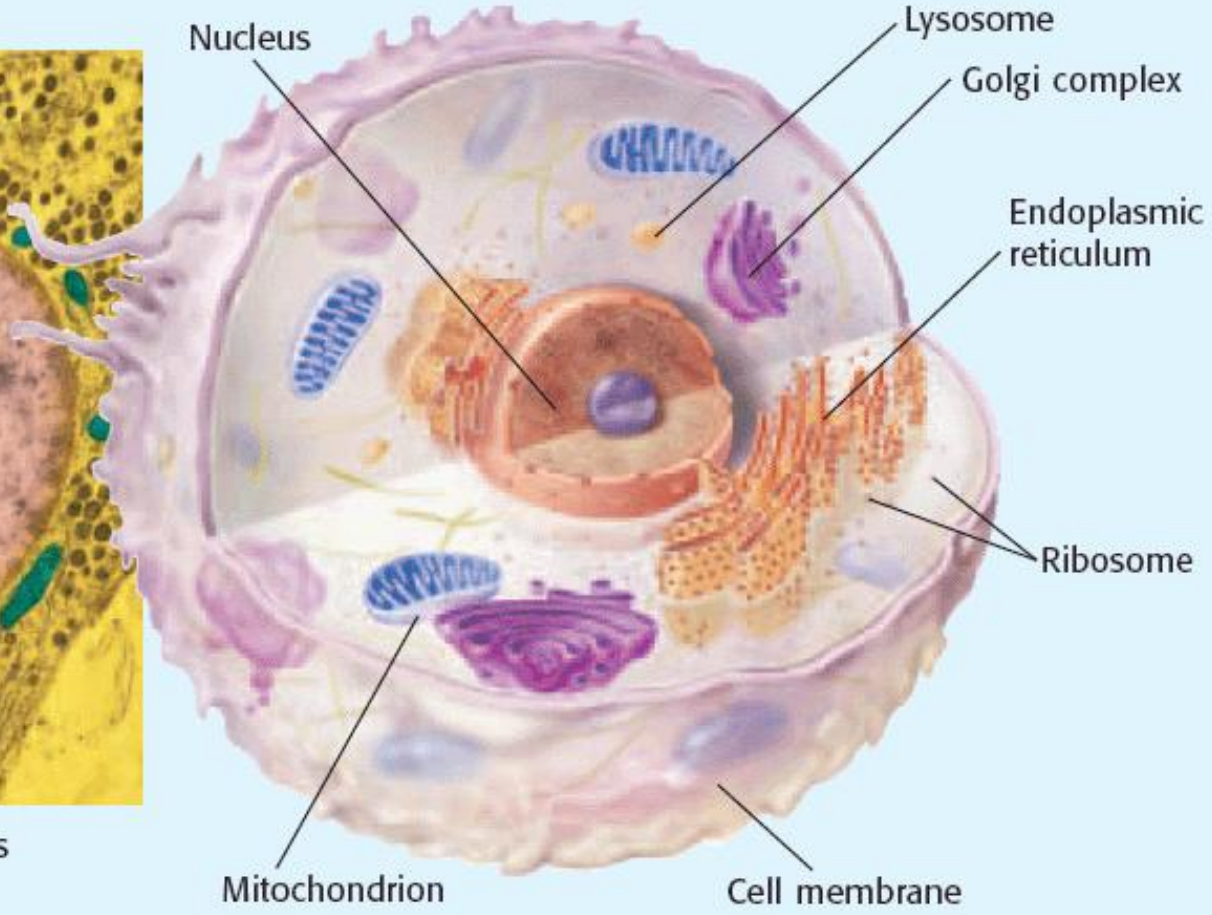
Eukaryotic Cells and Eukaryotes

• Many eukaryotes are multicellular, which means that they are made of many cells.

• Examples of multicellular eukaryotes are animals (including humans), plants, mushrooms, and algae. Examples of single-celled eukaryotes are amoebas and yeasts.

A Typical Eukaryotic Cell





Bellringer

List three differences between prokaryotic and eukaryotic cells.

Write your answer in your **science journal.**

End Of Slide

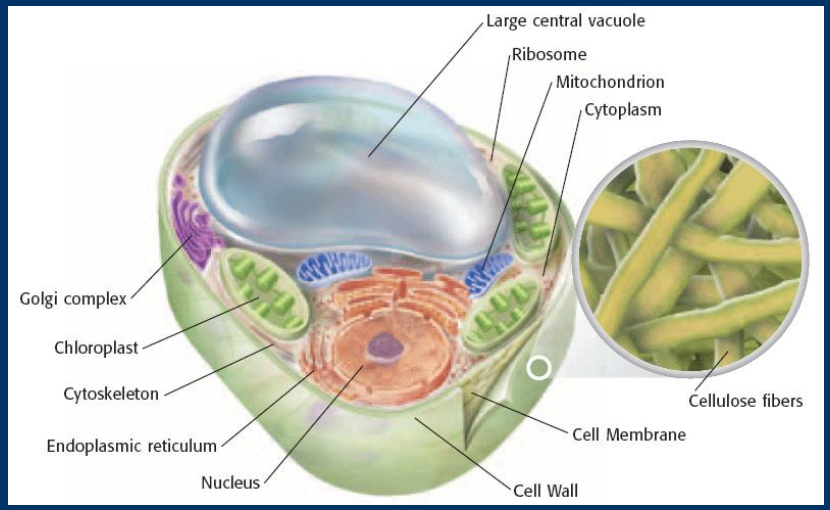
Objectives

- **Identify** the different parts of a eukaryotic cell.
- **Explain** the function of each part of a eukaryotic cell.

Cell Wall

• Some eukaryotic cells have cell walls. A **cell wall** is a rigid structure that gives support to a cell. The cell wall is the outermost structure of a cell.

• Plants and algae have cell walls made of a complex sugar called *cellulose*. The cell walls of plant cells help plants retain their shape.



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Cell Membrane

- All cells have cell membranes. The cell membrane is a protective barrier that encloses a cell.

- The cell membrane is the outermost structure in cells that lack a cell wall. In cells that have a cell wall, the cell membrane lies just inside the cell wall.

- The cell membrane contains proteins, lipids, and phospholipids.

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Cell Membrane, *continued*

- Lipids are a group of compounds that do not dissolve in water. Lipids are “water fearing” or *hydrophobic*.

- Phospholipids are lipids that contain phosphorus. The phosphorus containing ends of phospholipids are “water loving” or *hydrophilic*.

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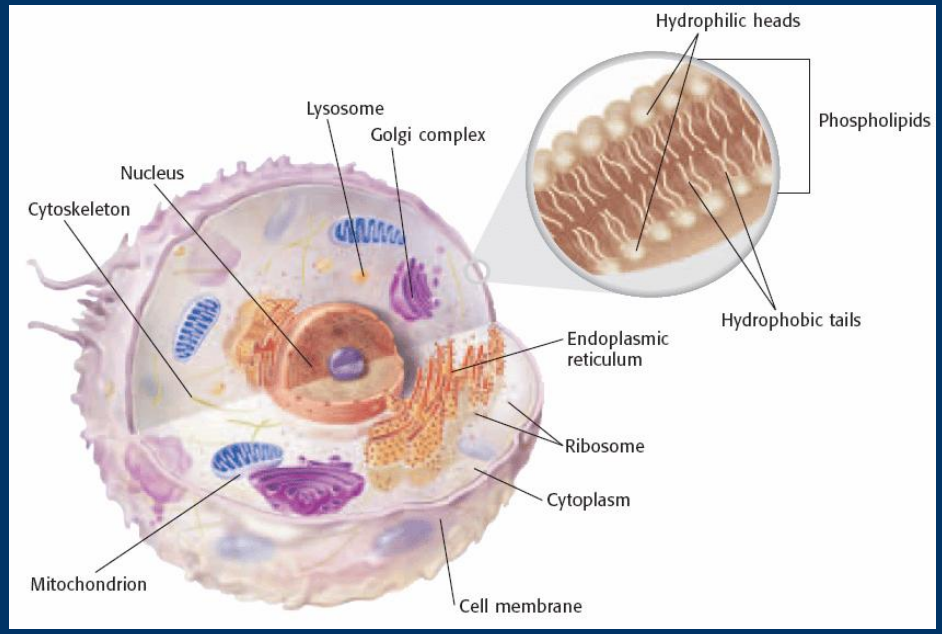
Cell Membrane, *continued*

• The cell membrane is made of two layers of phospholipids. It allows nutrients to enter and wastes to exit the cell.



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Cytoskeleton

- The cytoskeleton is a web of proteins in the cytoplasm. It acts as both a muscle and a skeleton.

- The cytoskeleton keeps the cell's membranes from collapsing and helps some cells move.

- The cytoskeleton is made of three types of protein. One protein is a hollow tube and the other two are long, stringy fibers.

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Nucleus

- The nucleus is a membrane-bound organelle that contains the cell's DNA. DNA contains the information on how to make a cell's proteins.

- Messages for how to make proteins are copied from the DNA. These messages are then sent out of the nucleus through the membranes.

- The nucleus is covered by two membranes. Materials cross this double membrane through pores.

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Ribosomes

• Organelles that make proteins are called **ribosomes.** Unlike most organelles, ribosomes are not covered by a membrane.

• Proteins are made of organic molecules called *amino acids*. All cells need proteins to live. All cells have ribosomes.

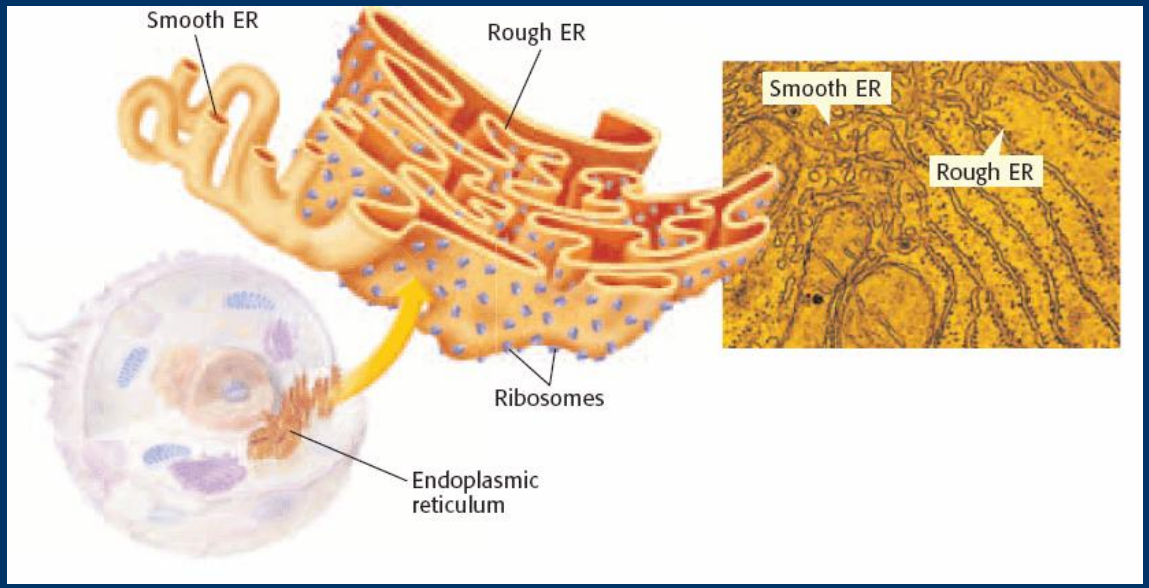
Endoplasmic Reticulum

• The **endoplasmic reticulum** (ER) is a system of folded membranes in which proteins, lipids, and other materials are made.

• The ER is part of the internal delivery system of the cell. Substances move through the ER to different places in the cell.

Endoplasmic Reticulum, *continued*

• Endoplasmic reticulum is either rough ER or smooth ER. The part of the ER covered in ribosomes is rough ER. ER that lacks ribosomes is smooth ER.



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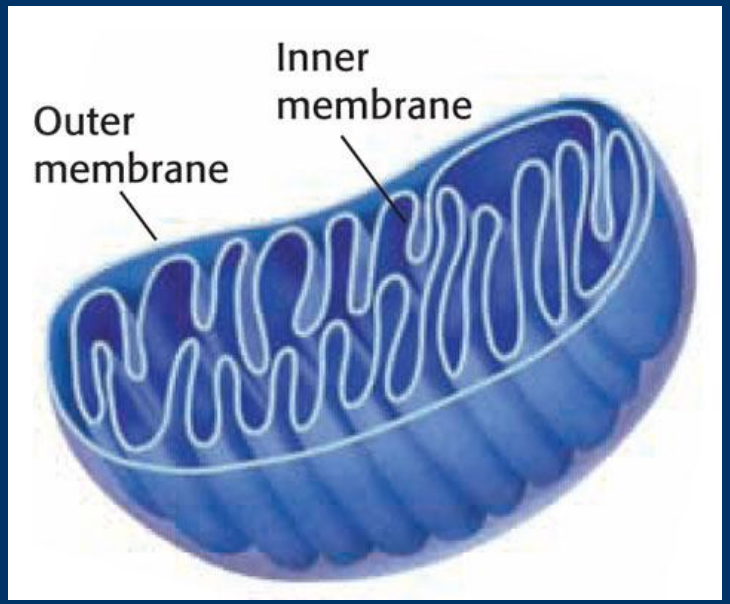
Mitochondria

• A **mitochondrion** is the organelle in which sugar is broken down to produce energy. Mitochondria are the main power source of a cell.

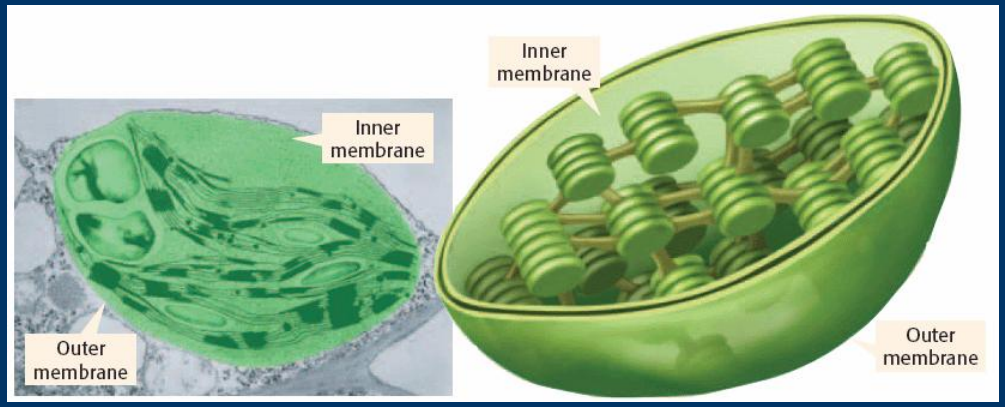
• Mitochondria are covered by two membranes, as shown at right.



Chloroplasts

• Chloroplasts are organelles in plant and algae cells in which photosynthesis takes place. Photosynthesis is the process by which plants and algae use sunlight, carbon dioxide, and water to make sugar and oxygen.

• Chloroplasts are covered by two membranes, as shown at right.



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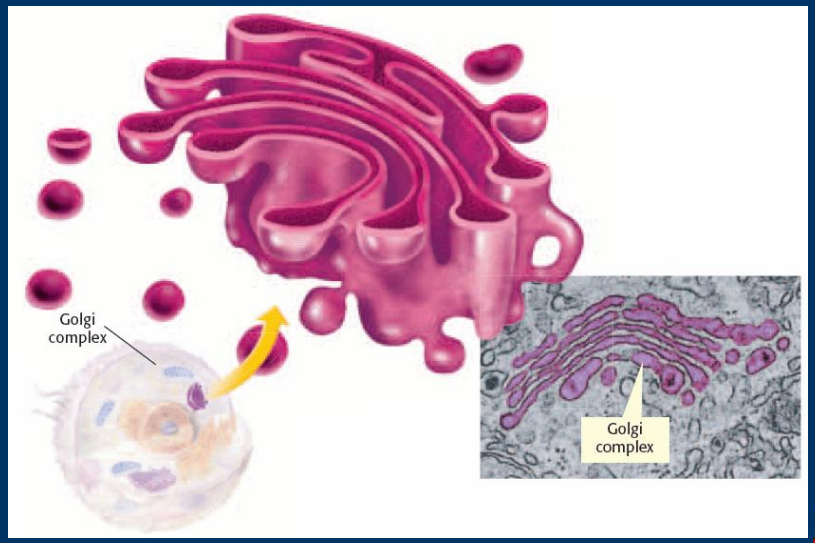
Golgi Complex

• The organelle that packages and distributes proteins is called the **Golgi complex.** The Golgi complex modifies lipids and proteins to do different jobs.

• Final products are enclosed in a piece of the Golgi complex membrane, which pinches off to form a small bubble.



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Cell Compartments

• The bubble that forms from the Golgi complex membrane is a vesicle. A **vesicle** is a small sac that surrounds material to be moved into or out of cell.

• Vesicles also move material within a cell. Vesicles carry new proteins from the ER to the Golgi complex. Other vesicles distribute material from the Golgi complex to other parts of the cell.

Cellular Digestion

• Lysosomes are vesicles found mainly in animal cells that are responsible for digestion inside a cell. **Lysosomes** are organelles that contain digestive enzymes.

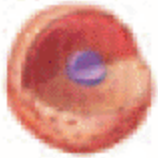
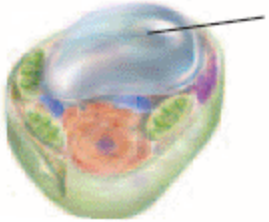
• Lysosomes destroy worn-out or damaged organelles, get rid of waste materials, and protect the cell from foreign invaders.

Cellular Digestion, *continued*

- **Vacuoles** are vesicles.

- In plant and fungal cells, some vacuoles act like lysosomes. The large central vacuole in plant cells stores water and other liquids.

Table 1 Organelles and Their Functions

 **Nucleus** the organelle that contains the cell's DNA and is the control center of the cell	 **Chloroplast** the organelle that uses the energy of sunlight to make food
 **Ribosome** the organelle in which amino acids are hooked together to make proteins	 **Golgi complex** the organelle that processes and transports proteins and other materials out of cell
 **Endoplasmic reticulum** the organelle that makes lipids, breaks down drugs and other substances, and packages proteins for Golgi complex	 **Large central vacuole** the organelle that stores water and other materials
 **Mitochondrion** the organelle that breaks down food molecules to make ATP	 **Lysosome** the organelle that digests food particles, wastes, cell parts, and foreign invaders

Bellringer

Why can't you use your teeth to breathe? Why can't you use your arm muscles to digest food?

Write your answers in your **science journal.**

End Of Slide

Objectives

- **List** three advantages of being multicellular.
- **Describe** four levels of organization in living things.
- **Explain** the relationship between the structure and function of a part of an organism.

End Of Slide

The Benefits of Being Multicellular

- **Larger Size** Larger organisms are prey for fewer predators. Larger predators can eat a wider variety of prey.

- **Longer Life** The life span of a multicellular organism is not limited to the life span of a single cell.

- **Specialization** Each type of cell has a particular job. Specialization makes the organism more efficient.

End Of Slide

Cells Working Together

- A **tissue** is a group of cells that work together to perform a specific job.

- Animals have four basic types of tissues: nerve tissues, muscle tissue, connective tissue, and protective tissue.

- Plants have three types of tissues: transport tissue, protective tissue, and ground tissue.

End Of Slide

Tissues Working Together

- A structure made up of two or more tissues working together to perform a specific function is called an **organ.**

- The heart, stomach, intestines, brain, and lungs are examples of organs in humans.

- Leaves, stems, and roots are examples of plant organs.

End Of Slide

Tissues Working Together, *continued*

- A group of organs working together to perform a particular function is called an **organ system.** Each organ system has a specific job in the body.

- Examples of organ systems are the digestive system, the respiratory system, and the cardiovascular system.

- Examples of plant organ systems are leaf systems, root systems, and stem systems.

End Of Slide

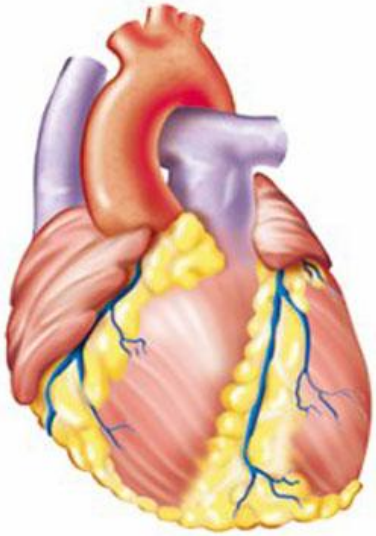
Levels of Organization in the Cardiovascular System

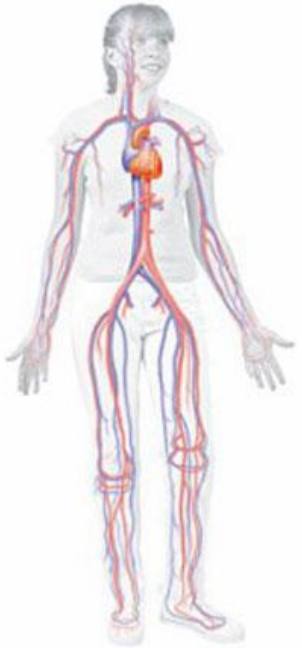
Cell
Cells form tissues.

Tissue
Tissues form organs.

Organ
Organs form organ systems.

Organ system
And organ systems form organisms such as you!





Overview of Organ Systems

Click below to watch the Visual Concept.

Visual Concept

End Of Slide

Organisms

• Anything that can perform life processes by itself is an **organism.**

• An organism made of a single cell is a unicellular organism. A unicellular organism must carry out all life processes in order for that cell to survive.

• In contrast, multicellular organisms have specialized cells that depend on each other for the organism to survive.

End Of Slide

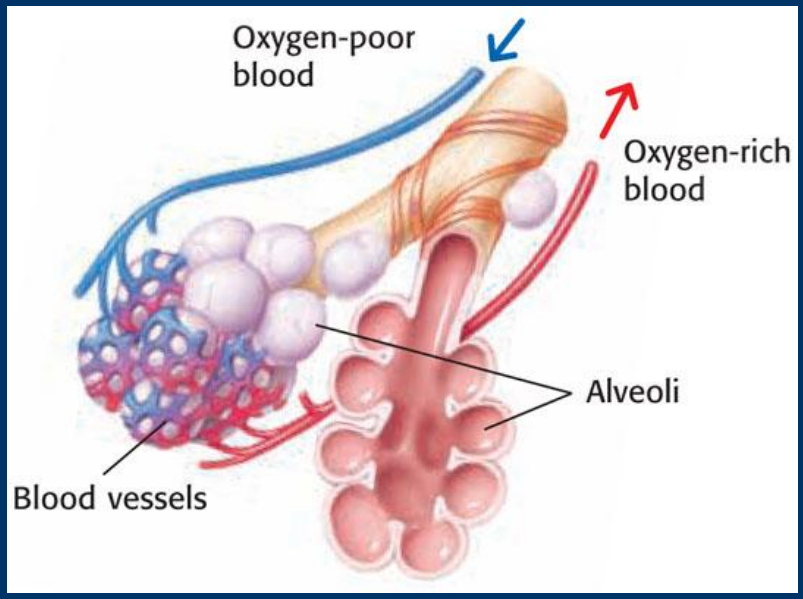
Structure and Function

- In organisms, structure and function are related.
- **Structure** is the arrangement of parts in an organism.
- **Function** is the job that the part does.

End Of Slide

Structure and Function, *continued*

- The structures of alveoli and blood vessels enable them to perform a function. Together, they bring oxygen into the body and get rid of its carbon dioxide.



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Concept Mapping

Use the terms below to complete the concept map on the next slide.

prokaryotes
cells
do
do not
plants
eubacteria
humans
bacteria
eukaryotes

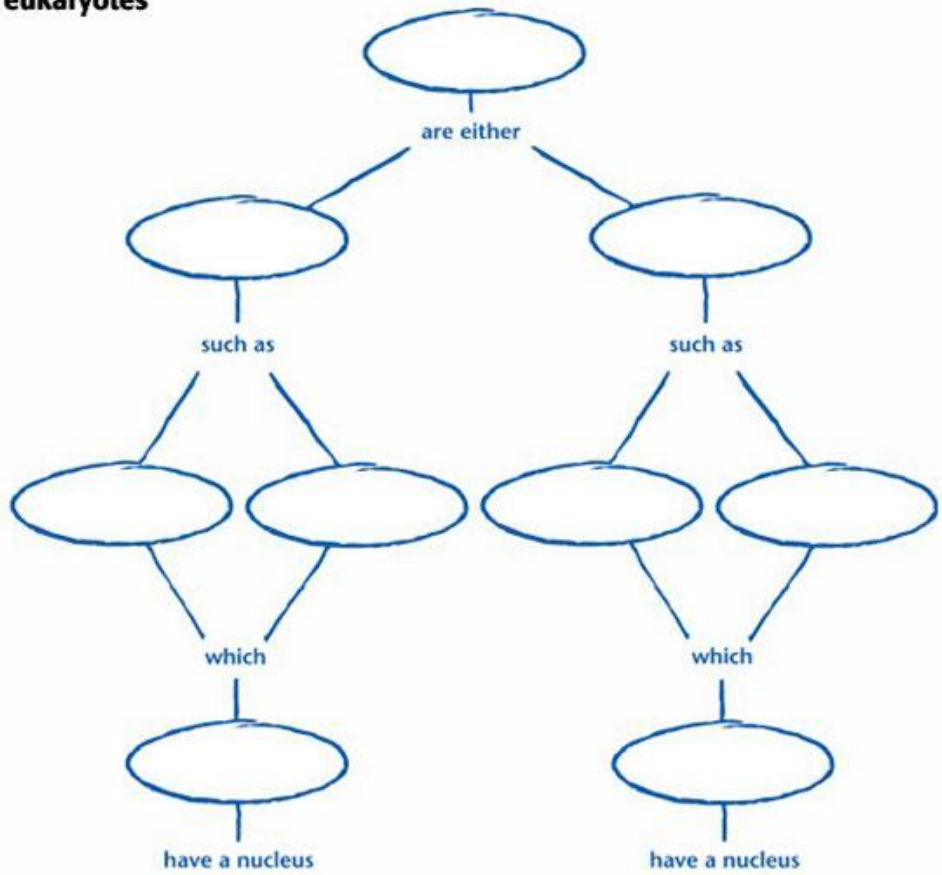
End of Slide

Cells: The Basic Units of Life

Cells: The Basic Units of Life

Use the following terms to complete the concept map below:

prokaryotes, cells, do, do not, plants, eubacteria, humans, bacteria, eukaryotes



Cells: The Basic Units of Life

Cells: The Basic Units of Life

Use the following terms to complete the concept map below:

prokaryotes, cells, do, do not, plants, eubacteria, humans, bacteria, eukaryotes