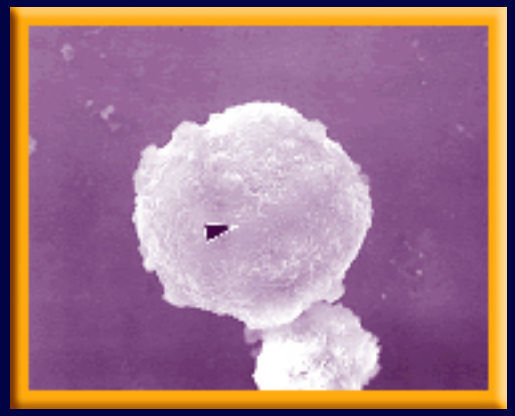
Chapter: Life's Structure and Classification

1

What are living things like?

- Any living thing is called an **organism**.
- Organisms vary in size—from the microscopic bacteria in mud puddles to gigantic oak trees—and are found just about everywhere.



1

What are living things like?

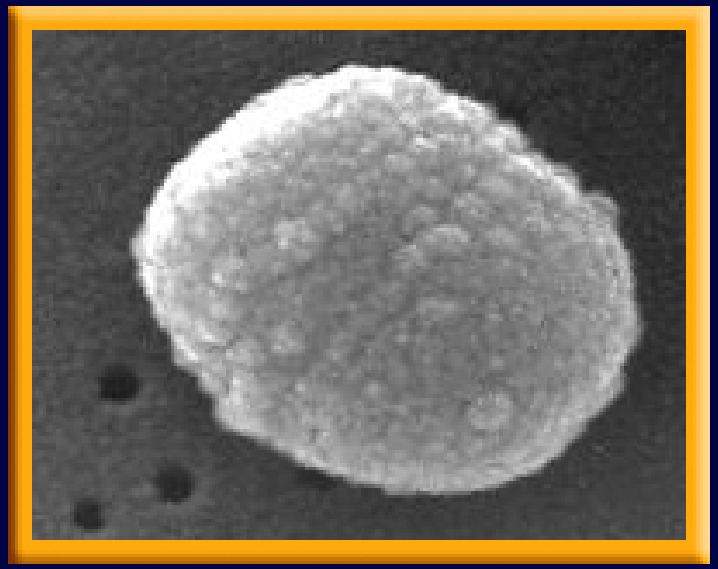
- They have different behaviors and food requirements.
- In spite of these differences, all organisms have similar traits.
- These traits determine what it means to be alive.

1

Living Things Are Organized

- A **cell** is the smallest unit of an organism that carries on the functions of life.

- Some organisms are composed of just one cell while others are composed of many cells.



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Living Things Are Organized

- Each cell has an orderly structure and contains the instructions for cellular organization and function in its hereditary material.
- All the things an organism can do are possible because of what their cells can do.

1

Living Things Grow and Develop

- Growth of a many-celled organism is mostly due to an increase in the number of cells.
- In one-cell organisms, growth is due to an increase in the size of cell.

1

Living Things Grow and Develop

- Organisms change as they grow.
- All of the changes that take place during the life of an organism is called development.

1

Living Things Grow and Develop

- The length of time an organism is expected to live is its life span.
- Some organisms have a short life span.
- Others have a much longer life span.
- Some bristlecone pine trees have been alive for more than 4,600 years!

1

Living Things Respond

- Living things must interact with their surroundings.
- Anything that causes some change in an organism is a stimulus.
- The reaction to a stimulus is a response.

1

Living Things Respond

- The regulation of an organism's internal, life-maintaining condition despite changes in its environment is called **homeostasis**.

- Homeostasis is a trait of all living things.

1

Living Things Use Energy

- The energy used by most organisms comes either directly or indirectly from the Sun.
- Plants and some other organisms use the Sun’s energy, carbon dioxide, and water to make food.

1

Living Things Use Energy

- Organisms that do not get energy directly from the Sun must take in oxygen in order to release the energy in foods.

1

Living Things Use Energy

- Some bacteria can’t use the Sun’s energy to produce food; instead, the bacteria use energy stored in some chemical compounds and carbon dioxide to make food.

1

Living Things Reproduce

- All living things eventually reproduce, to make more of their own kind.
- Some bacteria reproduce every 20 minutes, while it might take a pine tree two years to produce seeds.
- Without reproduction, living things would not exist to replace those individuals that die.

1

What do living things need?

- All living things need a place to live, water, and food source to survive.

1

A Place to Live

- All organisms need a place to live that is suited to their unique needs.
- Could a cactus survive in Antarctica, or a penguin in the Sahara?
- A place to live also provides enough space for the organism.

1

Water

- All organisms must take in water from their surroundings.
- Organisms take in and give off large amounts of water each day.

1

Water

- Homeostasis balances the amount of water exchanged.
- Water performs many functions, such as transporting materials within a cell between cells.

1

Food Sources

- Living things are made up of substances such as proteins, fat, and sugars.
- Animals take in these substances as part of the foods that they eat.
- Plants and some bacteria make their own food.

1

Food Sources

- When organisms die, substances in their bodies are broken down and released into the soil or air.
- The substances can then be used again by other living organisms.

1

Question 1

A _____ is the smallest unit of an organism that carries on the functions of life.

Answer

The answer is cell. All the things an organism can do are possible because of what their cells can do.

1

Question 2

Any living thing is called a(n) _____.

Answer

The answer is organism. All organisms have similar traits which determine what it means to be alive.

1

Question 3

Which is the smallest unit of an organism that can carry on life functions?

A. cell
B. organ
C. organ system
D. tissue

1

Answer

The correct answer is A. The human body is organized into many different types of cells.

2

Classification

- Carolus Linnaeus, a Swedish naturalist, developed a new system of grouping organisms that was accepted and used by most scientists.
- His classification system was based on looking for organisms with similar structures.
- Linnaeus also developed a scientific naming system that is still used today.

2

Binomial Nomenclature

- The two-word naming system that Linnaeus used to name various organisms is called **binomial nomenclature** (bi NOH mee ul · NOH mun klay chur).

- This two-word name is an organism's species.

2

Binomial Nomenclature

- The first word of the two-word name identifies the genus of the organism.

Ambystoma

genus

- A **genus** is a group of similar species.

- The second word of the name usually describes a feature.

tigrinum

feature

2

Uses of Scientific Names

- Scientific names are used for four reasons.
- First, they help avoid mistakes.
- Often, common names for two different organisms are the same.
- Scientific names help distinguish between those organisms.

2

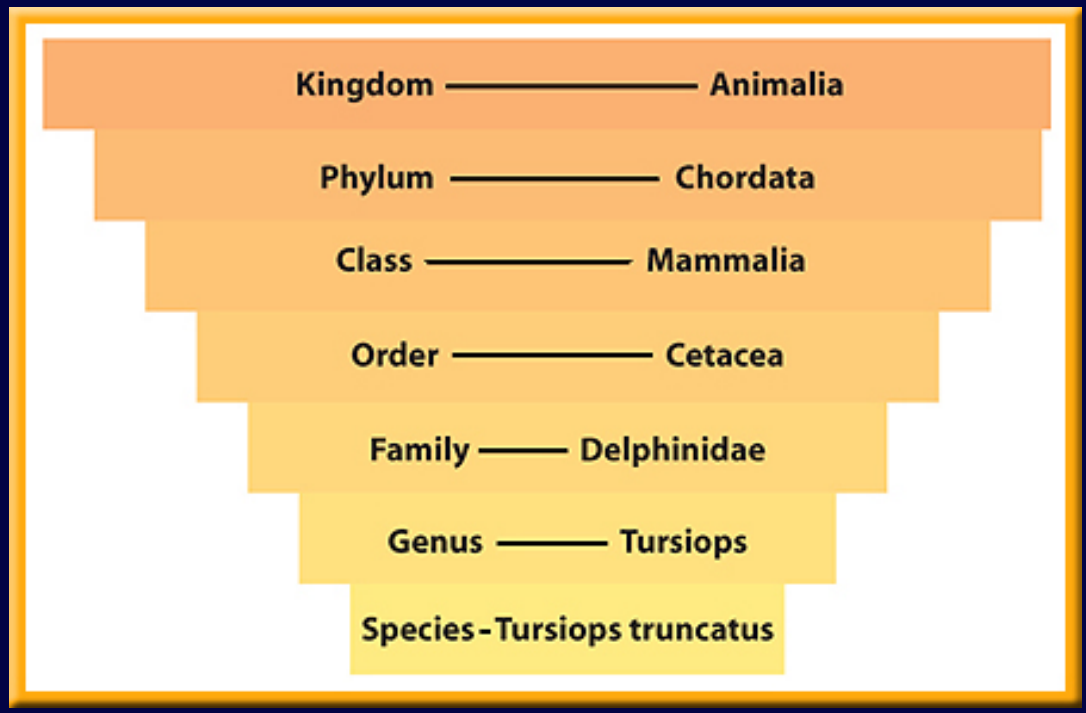
Uses of Scientific Names

- Second, organisms with similar evolutionary histories are classified together.
- Third, scientific names give descriptive information about the species.

2

Uses of Scientific Names

- Fourth, scientific names allow information about organisms to be organized easily and efficiently.
- The classification of the bottle-nosed dolphin shows that it is in the order Cetacea.



2

Modern Classification

- Like Linnaeus, modern scientists use similarities in structure to classify organisms.
- They also study fossils, hereditary information, and early stages of development.

2

Modern Classification

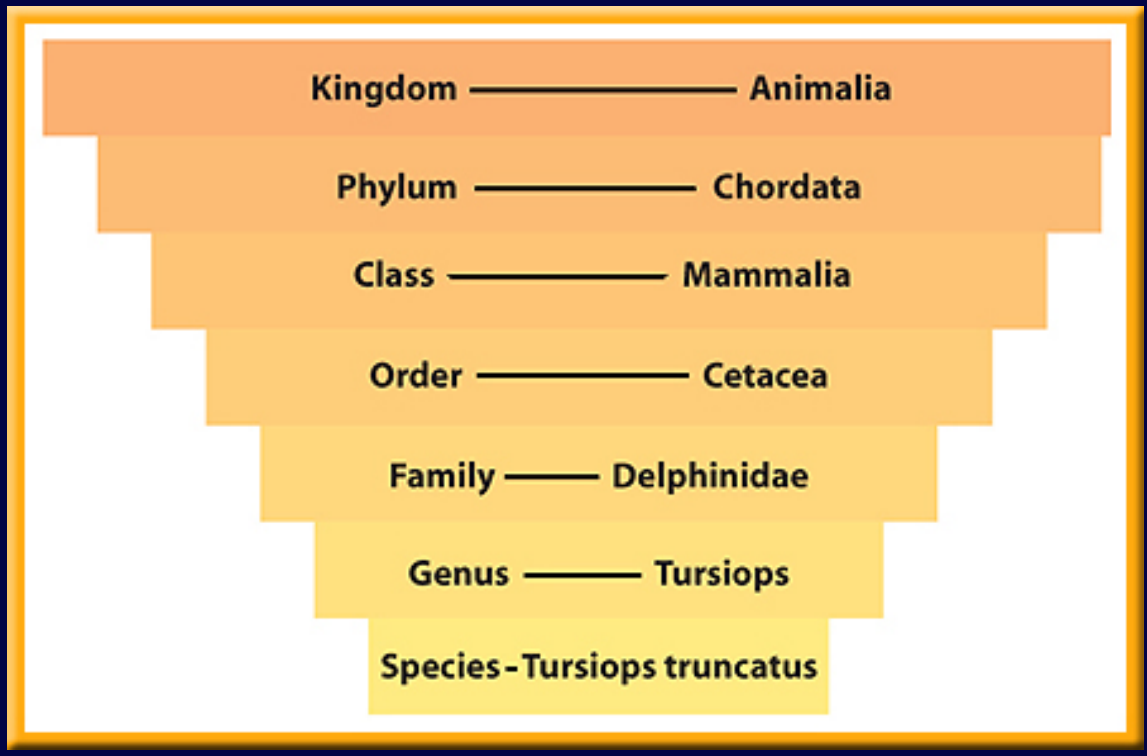
- **Phylogeny** (fi LAH juh nee) is the evolutionary history of an organism, that is, how the organism has changed over time.

- Today, it is the basis for the classification of many organisms.

2

Modern Classification

- In the classification system used today, the smallest group is a species.
- There are broader groups preceding species, the largest of which is a **kingdom**.



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Modern Classification

- Some scientists have proposed that before organisms are grouped into kingdoms, they should be placed in larger groups called domains.

- One proposed system groups all organisms into three domains.

2

Tools for Identifying Organisms

- Scientists use field guides and dichotomous (di KAH tuh mus) keys to identify organisms.

Mice of North America	
1. Tail hair	a. no tail hair; scales show plainly; house mouse, *Mus musculus* b. hair on tail, go to 2
2. Ear size	a. ears small and nearly hidden in fur, go to 3 b. ears large and not hidden in fur, go to 4
3. Tail length	a. less than 25 mm; woodland vole, *Microtus pinetorum* b. more than 25 mm; prairie vole, *Microtus ochrogaster*
4. Tail coloration	a. sharply dark above; deer mouse, *Peromyscus maniculatus* b. slightly dark above; white-footed mouse, *Peromyscus leucopus*

2

Tools for Identifying Organisms

- A dichotomous key is a detailed list of identifying characteristics that includes scientific names.

Mice of North America	
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2

Question 1

_____ is the two word naming system used to name various organisms.

Answer

The answer is binomial nomenclature. This two-word name is an organism's species.

2

Question 2

_____ is the evolutionary history of an organism.

Answer

The answer is phylogeny. Scientists study fossils, heredity information, and early stages of development to determine an organism's phylogeny.

2

Question 3

What is this table an example of?

Mice of North America	
1. Tail hair	a. no tail hair; scales show plainly; house mouse, *Mus musculus* b. hair on tail, go to 2
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2

Answer

The answer is dichotomous key. A dichotomous key is a detailed list of identifying characteristics that include scientific names.

3

Viewing Cells

- The first microscope was made by a Dutch optometrist.
- He put two magnifying glasses together in a tube and got an image that was larger than the image that was made by either lens alone.

3

Viewing Cells

- In the mid 1600s, Antonie van Leeuwenhoek, a Dutch fabric merchant, made a simple microscope with a tiny glass bead for a lens.

- These crude early microscopes eventually led to the types of microscopes that scientists use today.

3

Development of the Cell Theory

- In 1665, Robert Hooke cut a thin slice of cork and looked at it under his microscope.
- To Hooke, the cork seemed to be made up of empty little boxes, which he named cells.

3

Development of the Cell Theory

- In the 1830s, Matthias Schleiden used a microscope to study plant parts.
- He concluded that all plants are made of cells.
- Theodor Schwann, after observing many different animal cells, concluded that all animals also are made up of cells.

3

Development of the Cell Theory

- Several years later, Rudolf Virchow hypothesized that cells divide to form new cells.
- Virchow proposed that every cell came from a cell that already existed.

3

Development of the Cell Theory

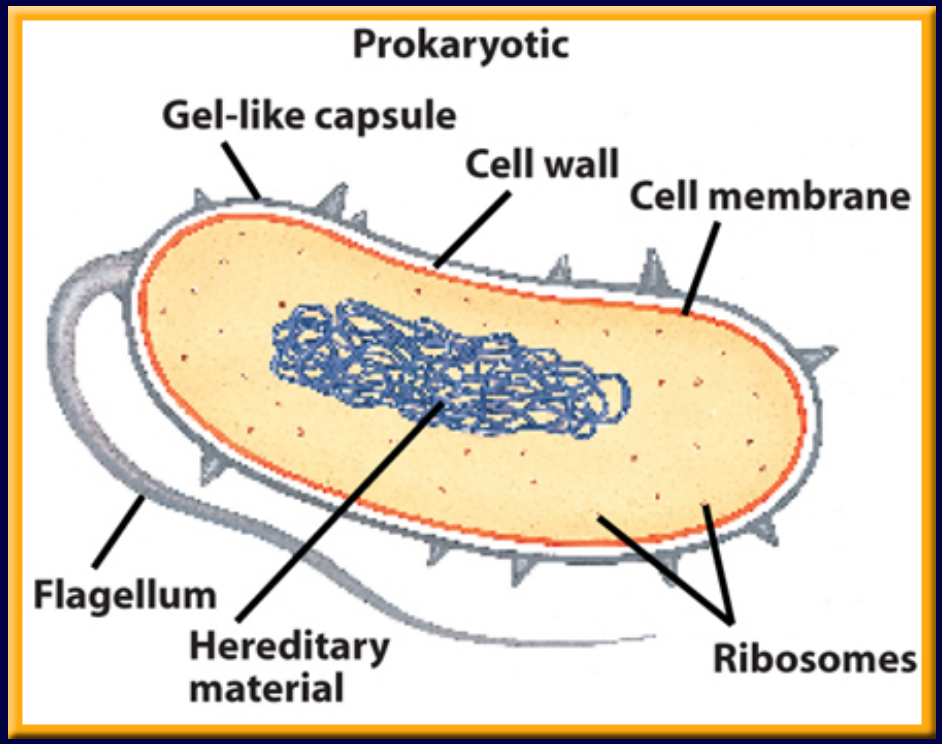
- His observations and conclusions and those of others are summarized in the **cell theory**.

The Cell Theory	
All organisms are made up of one or more cells.	An organism can be one cell or many cells like most plants and animals.
The cell is the basic unit of organization in organisms.	Even in complex organisms, the cell is the basic unit of structure and function.
All cells come from cells.	Most cells can divide to form two new, identical cells.

3

Cellular Organization

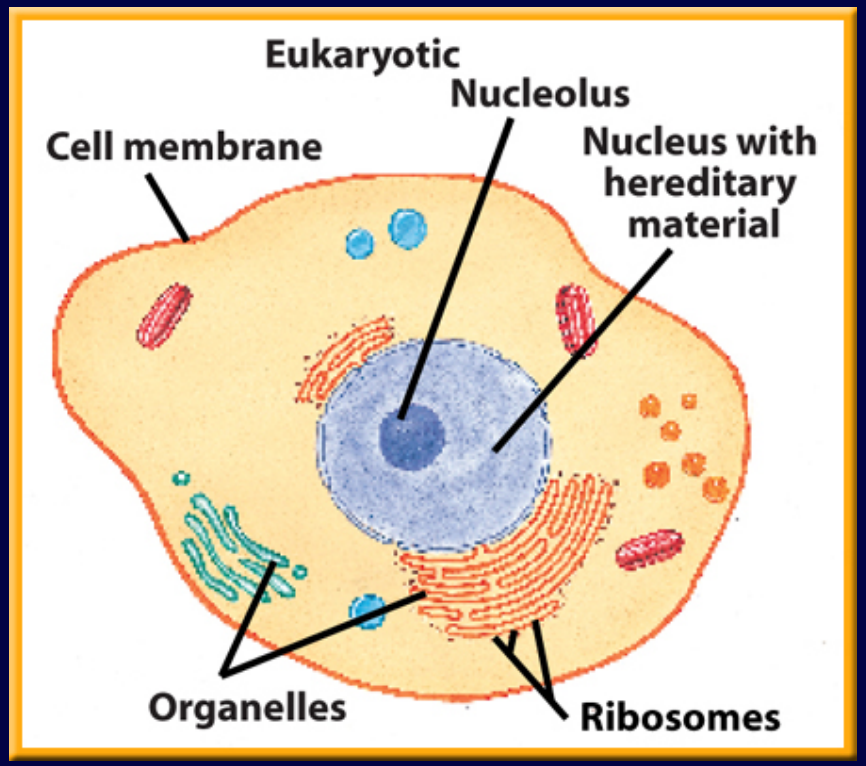
- Scientists have found that cells can be separated into two groups.
- Cells without membrane-bound structures are called prokaryotic (proh kayr ee AH tihk) cells.



3

Cellular Organization

- Cells with membrane-bound structures are called eukaryotic (yew kayr ee AH tihk) cells.

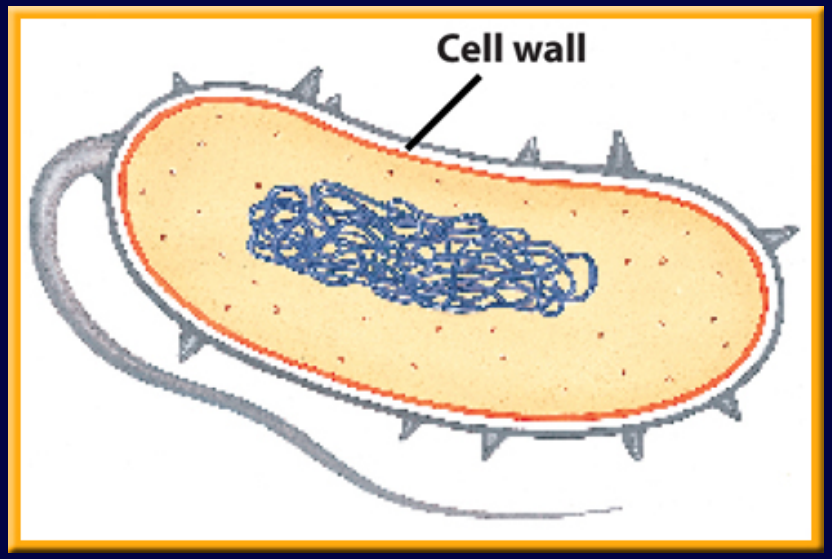


- All cells must constantly take in nutrients, store, produce, and breakdown substances, and take in and use energy.

3

Cell Wall

- The cells of plants, algae, fungi, and most bacteria are enclosed in a cell wall.
- **Cell walls** are tough, rigid outer coverings that protect cells and give them shape.



- A plant cell wall is mostly made up of a carbohydrate called cellulose.

3

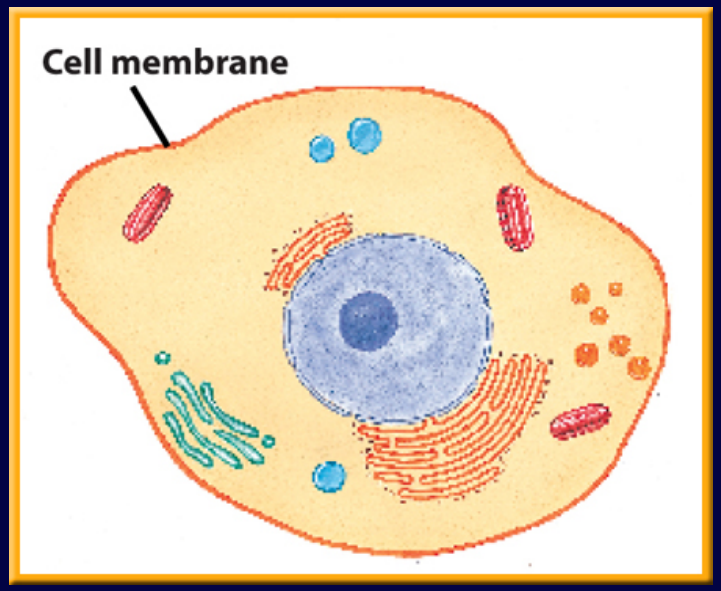
Cell Wall

- Cell walls also may contain pectin and lignin.
- Pectin aids in cell growth, development, defense, and strength.
- Lignin is a compound that makes cell walls rigid.

3

Cell Membrane

- The protective layer surrounding every cell is the **cell membrane**.
- The cell membrane regulates interactions between the cell and its environment.



- The cell membrane allows nutrients to move into the cell, while waste products leave.

3

Cytoplasm

- Cells are filled with a gelatinlike substance called **cytoplasm** (SI toh pla zuhm) that constantly flows inside the cell membrane.
- Most of a cell's life processes occur in the cytoplasm.

3

Cytoplasm

- Throughout the cytoplasm is a framework called the cytoskeleton, which helps the cell maintain or change its shape and enables some cells to move.

- The cytoskeleton is made up of thin, hollow tubes of protein and thin, solid protein fibers.

3

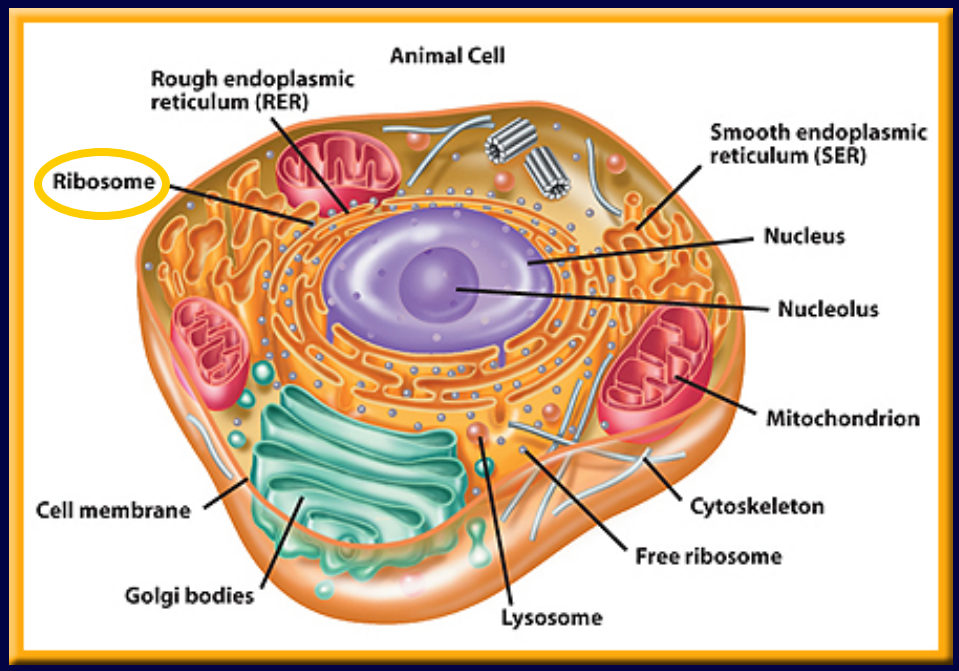
Manufacturing Proteins

- One substance that takes part in nearly every cell activity is protein.
- Proteins are part of cell membranes and are needed for chemical reactions that take place in the cytoplasm.

3

Manufacturing Proteins

- Cells make their own proteins on small structures called **ribosomes**.



- Ribosomes receive directions from the hereditary material on how, when, and in what order to make specific proteins.

3

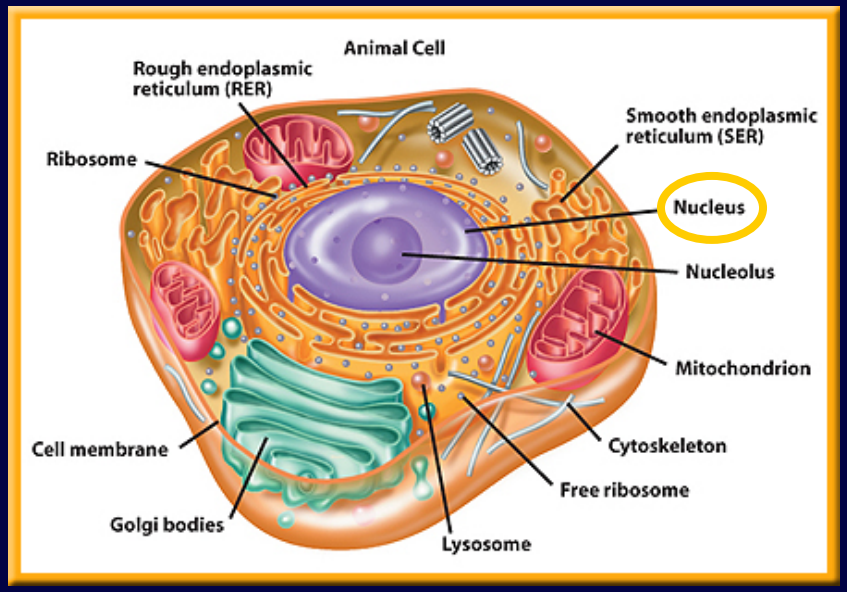
Membrane-Bound Organelles

- Within the cytoplasm of eukaryotic cells are structures called **organelles**, the largest of which is usually the nucleus.
- Most organelles, are surrounded by a membrane.
- Ribosomes are considered organelles, but are not membrane-bound.

3

Nucleus

- All celluar activities are directed by the **nucleus**.
- The nucleus contains long, threadlike, hereditary materials made of DNA.

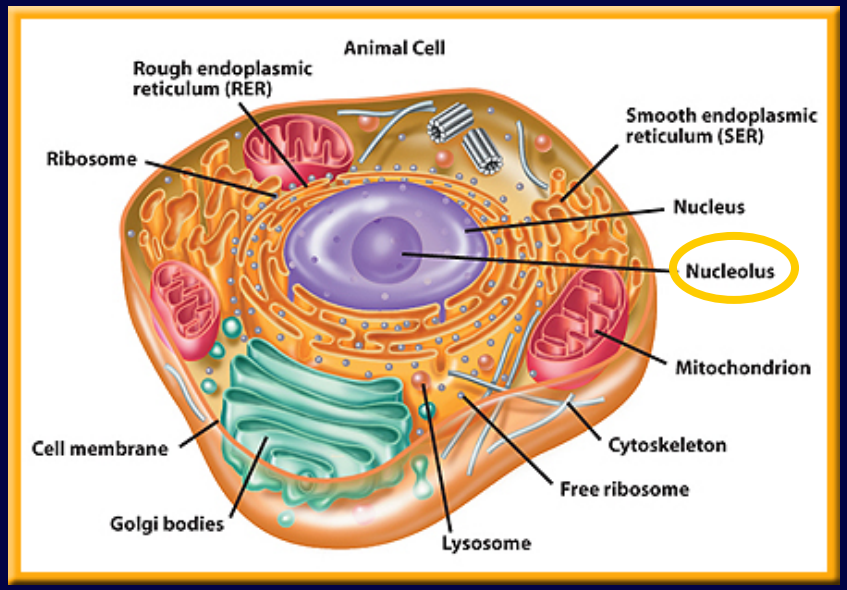


- DNA is the chemical that contains the code for cell's structure and activities.

3

Nucleus

- A structure called a nucleolus also is found in the nucleus, and is where most ribosomes are made in a eukaryotic cell.



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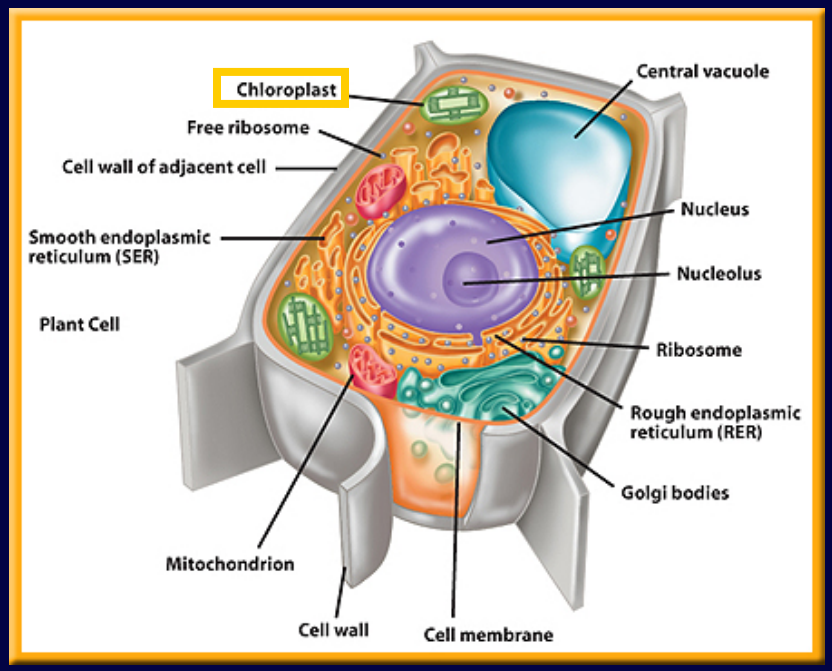
Organelles That Process Energy

- In plant cells, food is made in green organelles in the cytoplasm called **chloroplasts** (KLOR uh plasts).



- Chloroplasts contain the green pigment chlorophyll.

3

Organelles That Process Energy

- Chlorophyll captures light energy that is used to make a sugar called glucose, and turns this light energy to chemical energy.
- The energy in food is stored until it is released, usually by mitochondria.

3

Organelles That Process Energy

- **Mitochondria** (mi tuh KAHN dree uh) (singular, mitochondrion), are organelles where energy is released when food is broken down into carbon dioxide and water.

3

Organelles That Process, Transport, and Store

- **Endoplasmic reticulum** is a series of folded membranes in which materials can be processed and moved around inside of the cell.

3

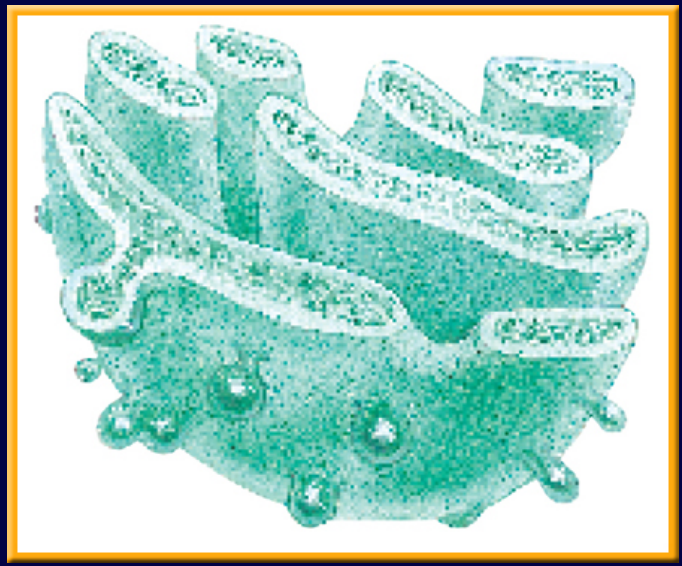
Organelles That Process, Transport, and Store

- The ER may be “rough” or “smooth.”
- Ribosomes are attached to areas on the rough ER.
- There they carry out their job of making proteins that are moved out of the cell or used within the cell.
- Smooth ER processes cellular substances such as lipids that store energy.

3

Organelles That Process, Transport, and Store

- After proteins are made in a cell, they are transferred to another type of cell organelle called the Golgi (GAWL jee) bodies.
- The **Golgi bodies** are stacked, flattened membranes.



3

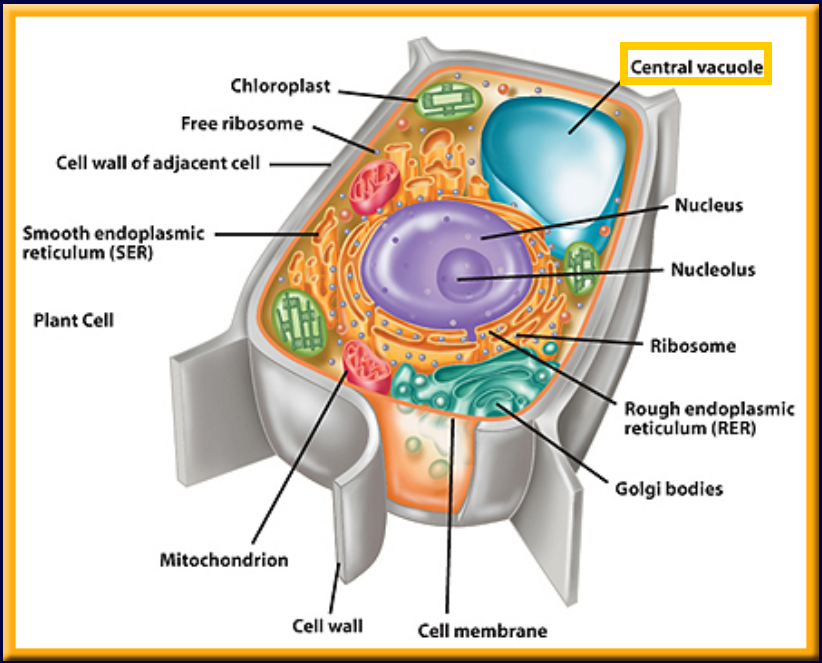
Organelles That Process, Transport, and Store

- The Golgi bodies sort proteins and other cellular substances and package them into membrane-bound structures called vesicles.

3

Organelles That Process, Transport, and Store

- Cells also have membrane-bound spaces called vacuoles for the temporary storage of materials.

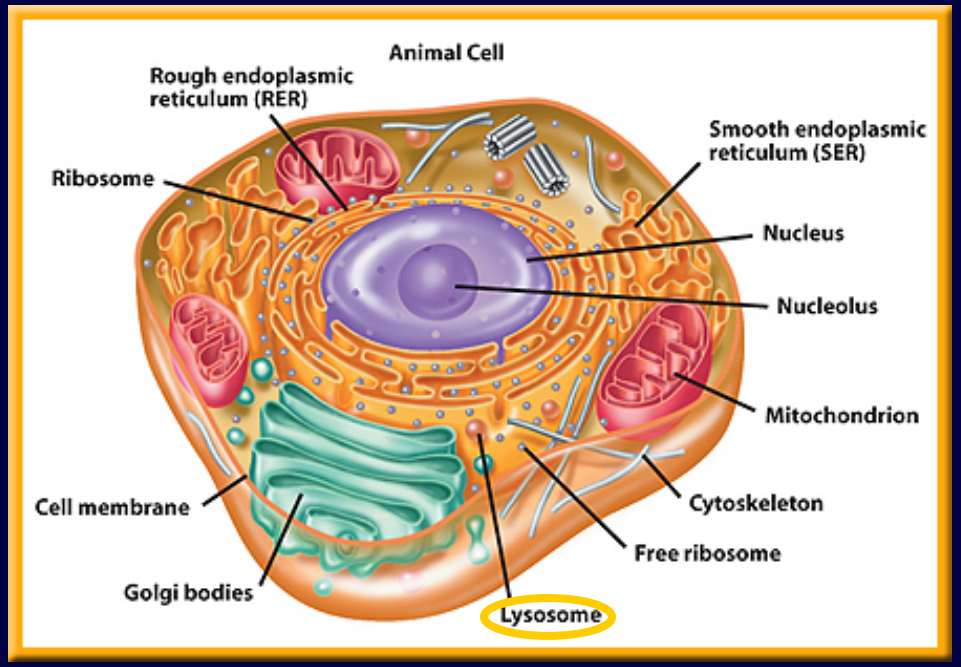


- A vacuole can store water, waste products, food, and other cellular materials.

3

Organelles That Recycle

- Organelles called lysosomes (LI suh sohmz) contain digestive chemicals that help break down food molecules, cell waste, and worn-out cell parts.
- Lysosomes also break down viruses and bacteria taken into a cell.



3

Organelles That Recycle

- Chemicals can be released into vacuoles when needed to break down its content.
- The lysosome's membrane prevents the digestive chemicals inside from leaking into the cytoplasm and destroying the cell.

3

Organelles That Recycle

- When a cell dies, the lysosome's membrane disintegrates, releasing digestive chemicals that allow the quick breakdown of the cell's contents.

3

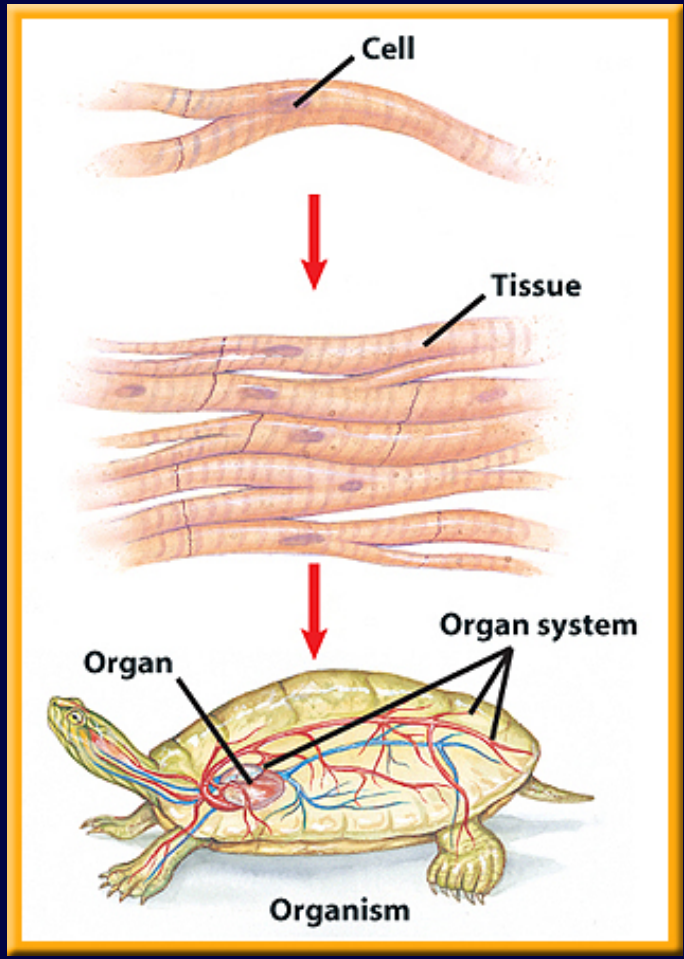
Many-Celled Organisms

- Cells in a many-celled organism do not work alone.
- Each cell carries on its own life functions while depending in some way on other cells in the organism.

3

Many-Celled Organisms

- A **tissue** is a group of similar cells that work together to do one job.
- Tissues are organized into organs.
- An **organ** is a structure made up of two or more different types of tissues that work together.



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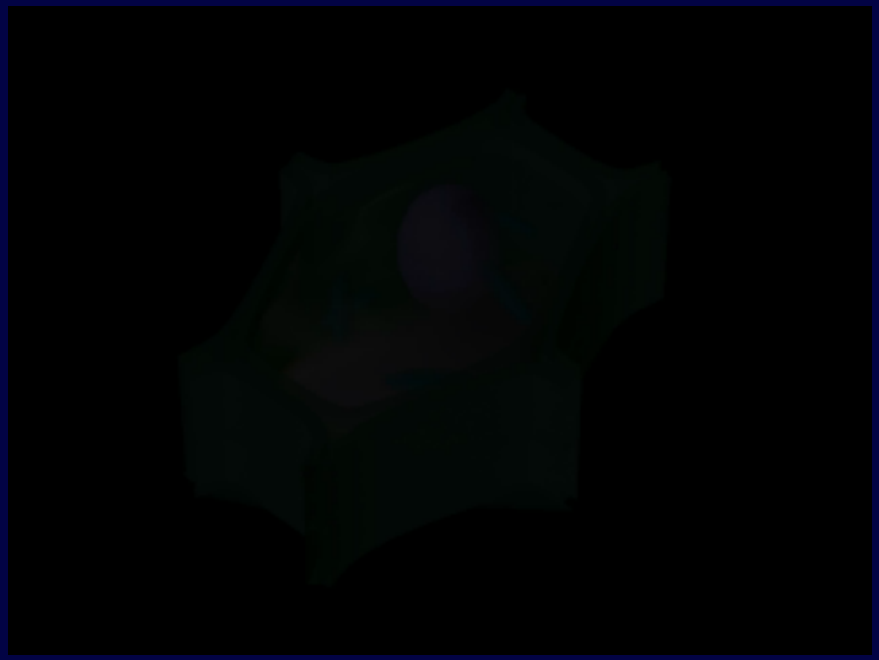
Many-Celled Organisms

- A group of organs working together to perform a certain function is an **organ system**.
- Organ systems work together to make up a many-celled organism.



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3

Question 1

The _____ is a framework of thin, hollow tubes of protein and thin, solid protein fibers found throughout the cytoplasm.

A. cytoskeleton
B. endoskeleton
C. exoskeleton
D. lignin

3

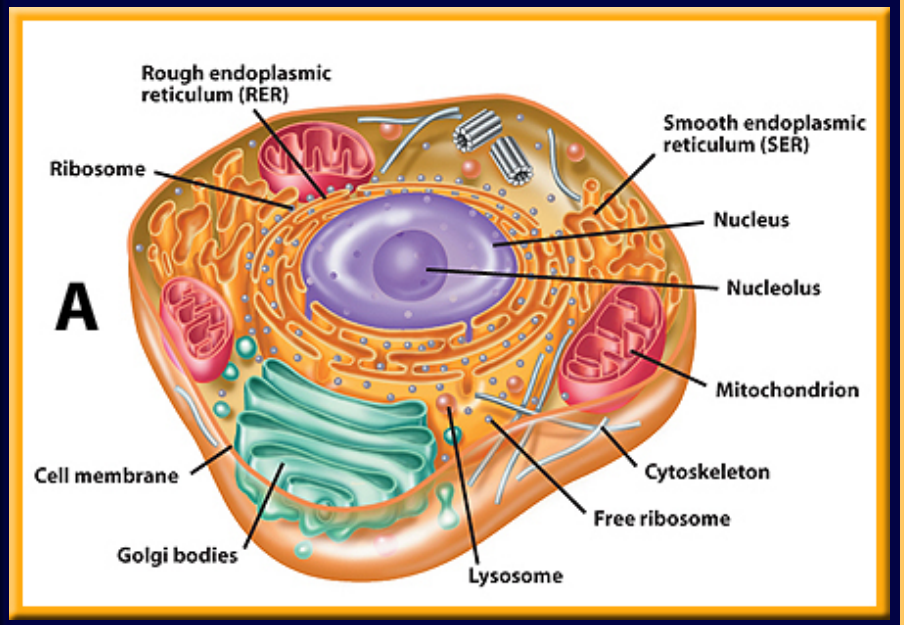
Answer

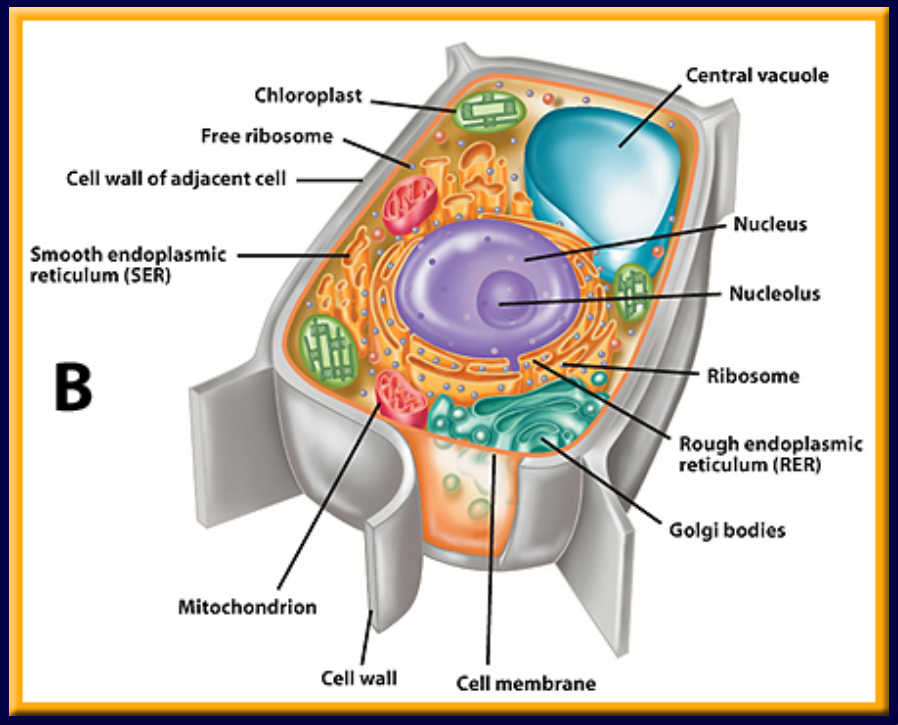
The answer is A. The cytoskeleton helps the cell maintain or change its shape.

3

Question 2

Which is a plant cell?





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Answer

The answer is B. Plant cells contain chloroplasts that use light to make sugar from carbon dioxide and water.

3

Question 3

What organelle contains digestive chemicals that help break down food molecules, cell wastes, and worn-out cell parts?

Answer

The answer is lysosomes. Lysosomes also break down viruses and bacteria taken into a cell.

4

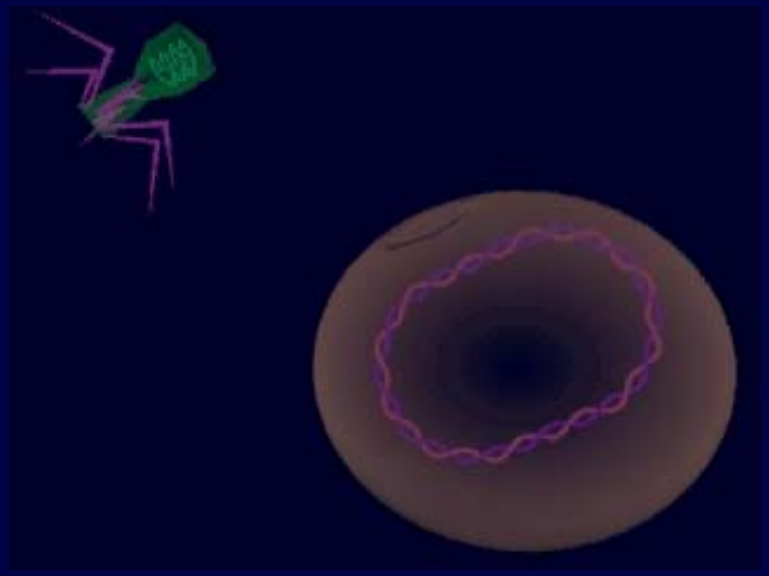
What are viruses?

- A **virus** is a strand of hereditary material surrounded by a protein coating.
- A virus multiplies by making copies of itself with the help of a living cell called a **host cell**.
- Viruses don’t have a nucleus, other organelles, or a cell membrane.

4

Active Viruses

- When a virus enters a cell and is active, it causes the host cell to make new viruses.
- This process destroys the host cell.



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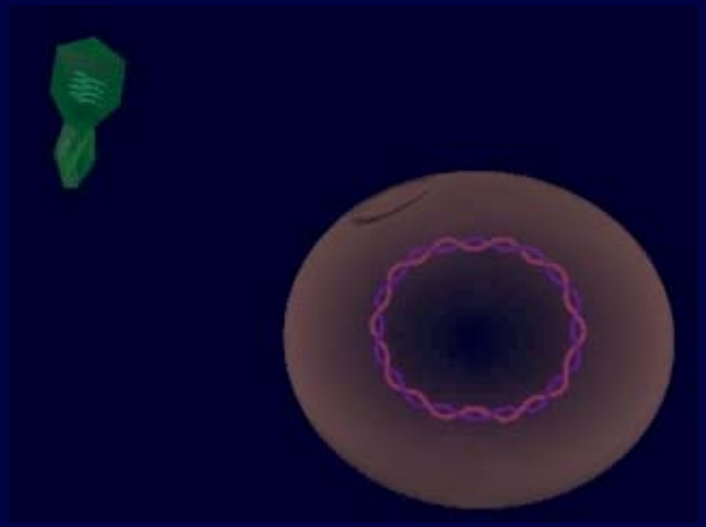
4

Latent Viruses

- Some viruses can be inactive, and are called latent.
- It does not immediately make new viruses or destroy the cell.
- A virus can be latent for many years.
- Then, at any time, certain conditions, either inside or outside the body, can activate the virus.



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4

How do viruses affect organisms?

- Most viruses can infect only specific kinds of cells.
- A few viruses affect a broad range of hosts.
- An example of this is the rabies virus.

4

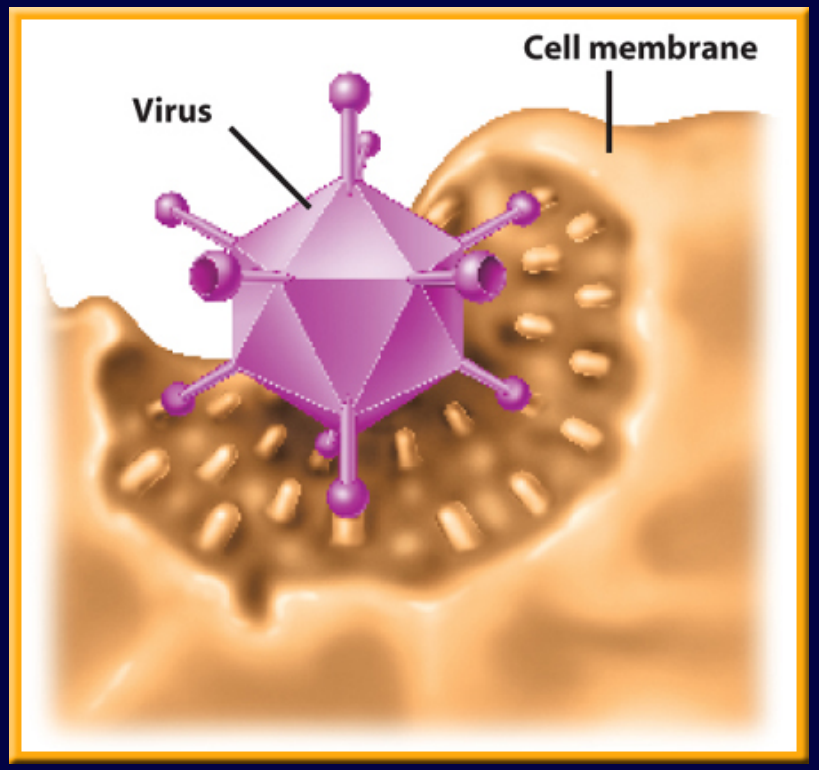
How do viruses affect organisms?

- A virus cannot move by itself, but it can reach a host's body in several ways.
- It can be carried onto a plant's surface by the wind or it can be inhaled by an animal.

4

How do viruses affect organisms?

- In a viral infection, the virus first attaches to the surface of the host cell.
- Viruses and the attachment sites of the host cell must match exactly, like a puzzle.
- That's why most viruses infect only one kind of host cell.



4

Treating and Preventing Viral Diseases

- Antibiotics do not work against viral diseases.
- Antiviral drugs are not widely used because of adverse side effects.
- Prevention is the best way to fight the diseases.

4

Treating and Preventing Viral Diseases

- Public health measures for viral diseases include vaccinating people, improving sanitary conditions, separating patients with diseases, and controlling animals that spread the disease.

4

Natural Immunity

- Interferons are proteins that protect cells from viruses.
- These proteins are produced rapidly by infected cells and move to noninfected cells in the host.
- They cause the noninfected cells to produce protective substances.

4

Vaccines

- A vaccine is made from weakened virus particles that cause your body to produce interferons to fight the infection.
- Edward Jenner is credited with developing the first vaccine in 1796.

4

Research with Viruses

- Scientists are discovering helpful uses for some viruses through research.
- One use, called gene therapy, is being tried on cells with defective hereditary material.

4

Research with Viruses

- Normal hereditary material is enclosed in viruses.
- The viruses then “infect” defective cells, taking the new hereditary material into the cells to replace the defective material.

4

Research with Viruses

- An active area of viral research is HIV/AIDS research.
- HIV stands for human immuno-deficiency virus, a virus that attacks the immune system.

4

Research with Viruses

- AIDS occurs worldwide, with 95 percent of the cases in developing countries.
- Currently, there is no known cure for AIDS.

HIV/AIDS in the World	
Adults age 15–49 with HIV/AIDS, 2001	37,100,000
New HIV infections, 2001	5,000,000
Adult HIV prevalence (%), 2001	1.20
Women age 15–49 with HIV/AIDS, 2001	18,500,000
Children with HIV/AIDS, 2001	3,000,000
AIDS deaths, 2001	3,000,000

Source: UNAIDS

4

Research with Viruses

- The research will hopefully lead to better treatments, a vaccine, and eventually a cure.

HIV/AIDS in the World	
Adults age 15–49 with HIV/AIDS, 2001	37,100,000
New HIV infections, 2001	5,000,000
Adult HIV prevalence (%), 2001	1.20
Women age 15–49 with HIV/AIDS, 2001	18,500,000
Children with HIV/AIDS, 2001	3,000,000
AIDS deaths, 2001	3,000,000

Source: UNAIDS

4

Question 1

A _____ is a strand of hereditary material surrounded by a protein coating.

Answer

The answer is virus. Chicken pox, colds, the flu, and AIDS are diseases called by nonliving particles call viruses.

4

Question 2

Who is credited with developing the first vaccine in 1796?

A. Antonie van Leeuwenhoek
B. Carolus Linnaeus
C. Edward Jenner
D. Rudolf Virchow

4

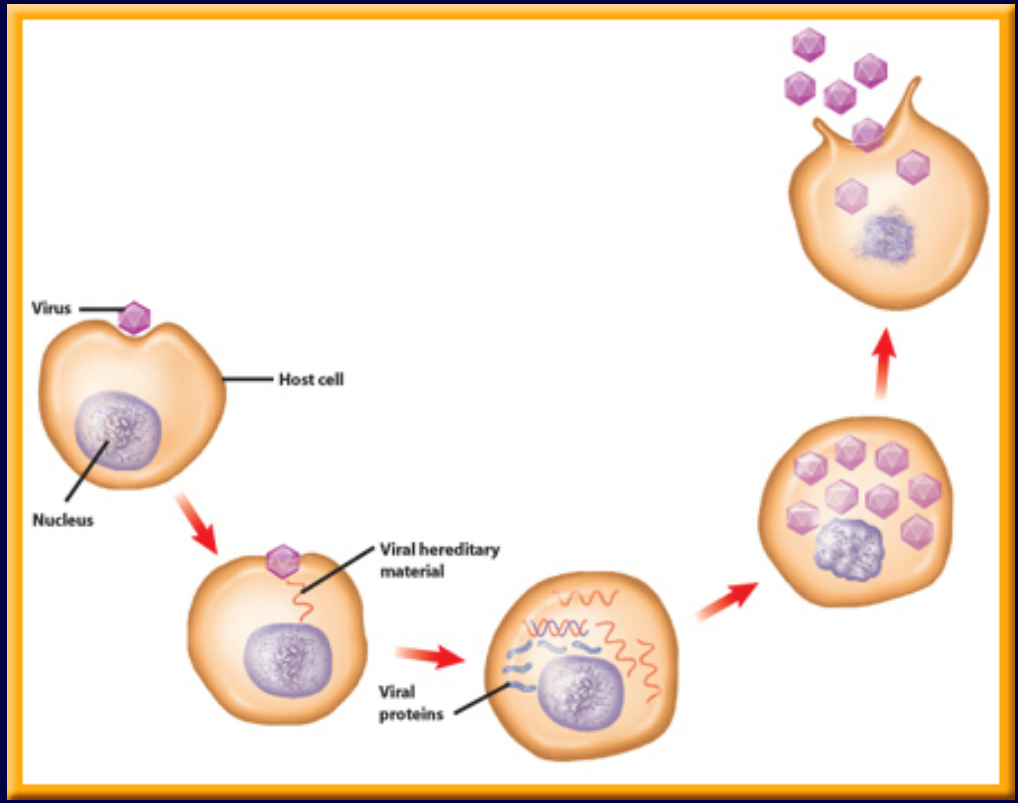
Answer

The answer is C. Edward Jenner injected a weakened form of the cowpox virus into healthy people, which protected them from smallpox.

4

Question 3

What happens to the host cell after new viruses are formed inside it?



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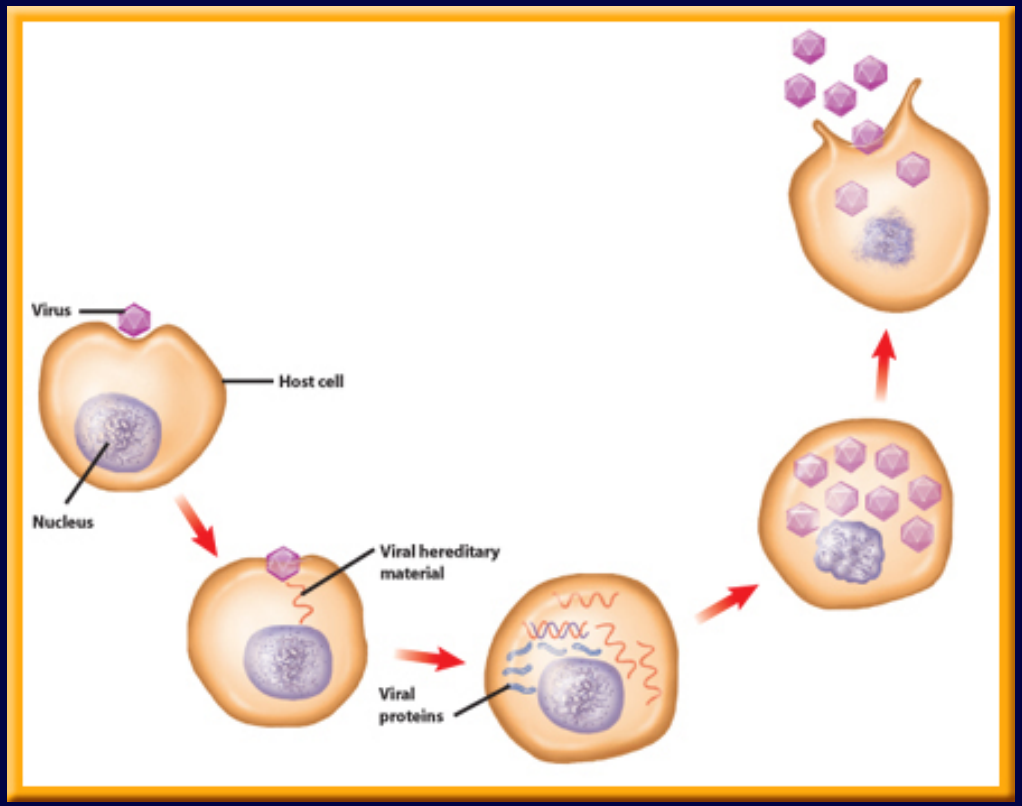
A. It is destroyed.
B. It releases the new viruses and continues its original functions.
C. It divides.
D. It grows.



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Answer

The answer is A. When an active virus causes the host cell to make new viruses, the host cell is always destroyed.

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