

Unit 2: Life Structure and Function

Module 1: Cells and Life...

Lesson 1: Exploring Life



ENGINEERING Connection

How have microscopes helped people learn about living things on a different scale?

Microscopes have enabled people to learn that living things are made of cells by allowing people to view living things on a smaller scale and in much more detail than with the unaided eye.

The Cell Theory	
Principle	Example
All living things are made of one or more cells.	: A frog's skin is made of many skin cells.
The cell is the basic unit of life.	: A single-celled amoeba performs all the functions of life, such as obtaining energy.
All new cells come from preexisting cells.	: A cell divides in two forming two new cells.

What kinds of technology might a microbiologist use on the job?
: computers, microscopes

What kinds of living things might a microbiologist study?
: bacteria, unicellular pond organisms, single cells of multicellular organisms

How is microbiology related to health care?
: Many diseases are caused by bacteria and other microscopic organisms.

What is one way that microbiology is related to ecology?
: Bacteria and other microscopic organisms play important roles in ecosystems, so microbiologists might study these organisms.



What are some examples of living things that are made up of many cells?

Any type of plant or animal, many types of fungi, and a few types of protists are multicellular.

What are some examples of living things that are made up of one cell?

Any type of bacteria, archaea, and some protists and fungi are unicellular.





How are unicellular and multicellular organisms similar?

Both are made up of cells.

What can you infer about the functions carried out by the single cell that makes up a unicellular organism?

The single cell must carry out all of the functions required for the organism to survive.



1. Organization

Living things are organized by...
having different structures that perform different functions,
such as digestion or movement.

Unicellular

organisms are less complex.

Multicellular

organisms are more complex.

2. Growth and development

Growth is...
the process of increasing in
size.

Development is...
a series of changes that occur
in an organism during its
lifetime.

3. Reproduction

Reproduction is...

the process by which organisms create new organisms.

Types of reproduction:

asexual

sexual

4. Response to stimuli

Internal stimuli are...

inside the organism.

Examples:

hunger, thirst

External stimuli are...

outside of the organism.

Examples:

light, temperature

5. Maintaining internal conditions

Maintaining internal conditions is called **homeostasis**

Examples of how organisms maintain internal conditions:

Sample answer: Organisms maintain internal conditions by regulating water and getting rid of wastes. Organisms can also regulate their body temperature.

6. Use of energy

Most organisms get their energy from
the Sun.

Plants, algae, and some types of microorganisms use
energy from the Sun to make food.

Other organisms obtain energy by eating plants or by eating other
animals that have eaten plants.

What is a difference between prokaryotic and eukaryotic cells? : Eukaryotic cells have genetic material surrounded by a lining.

ASK: What groups of organisms have eukaryotic cells?
plants, animals, fungi, protists

ASK: What groups of organisms have prokaryotic cells?
prokaryotes (bacteria and archaea)

ASK: What kingdoms are part of the Domain Eukarya?

Protista, Fungi, Plantae, Animalia

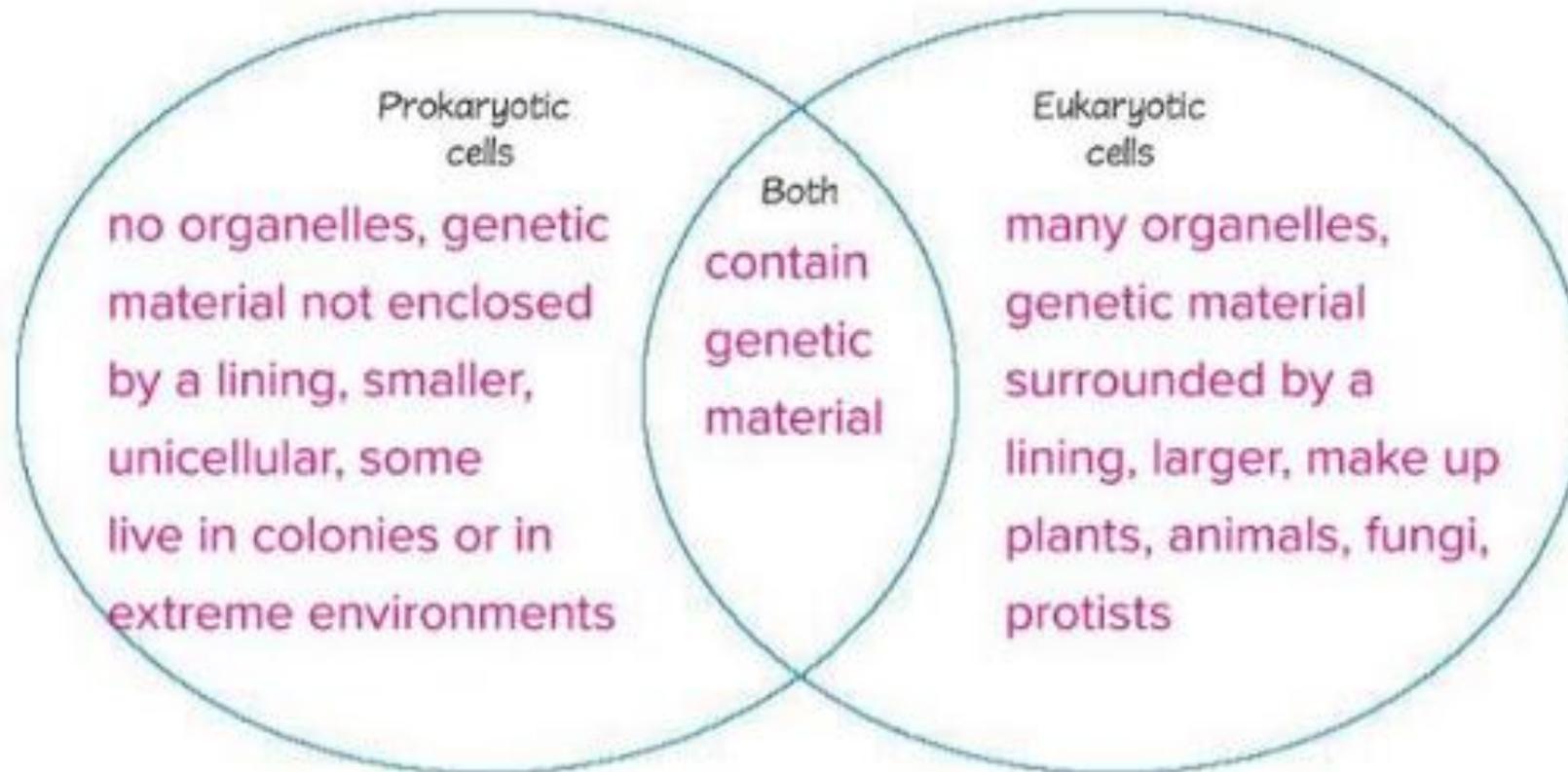
ASK: How many kingdoms are in the Domain Bacteria and Domain Archaea? **one each**

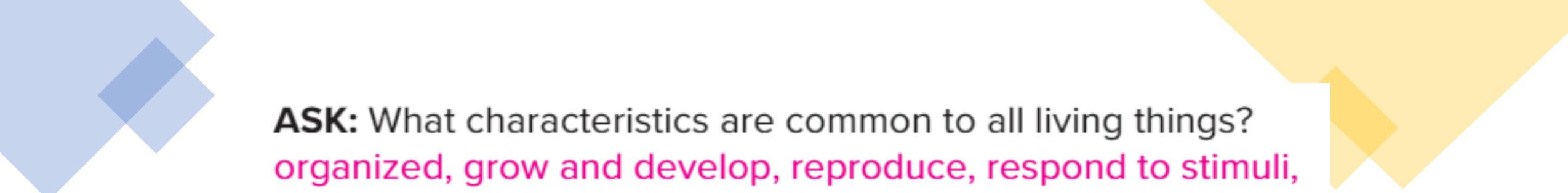
ASK: To what domain and kingdom do humans belong?

Domain Eukarya, Kingdom Animalia

ASK: What types of information are used to classify organisms into domains and kingdoms? **Sample answers: cell type, habitat, ancestry of the organism**

Compare and contrast prokaryotic cells and eukaryotic cells by completing the Venn diagram on the next page.





ASK: What characteristics are common to all living things?
organized, grow and develop, reproduce, respond to stimuli,
maintain internal conditions, use energy, made up of one or
many cells

ASK: How many of these characteristics does something
need to have in order to be considered living? **all of the
characteristics**

After You Read

ASK: What evidence would you use to support the argument
that viruses are nonliving? **Answers may vary. Sample
answers: Viruses are not made up of cells; Viruses do not
grow or change.**



2. If a living organism contains a cell with the structures seen below, which of the following can you conclude about the organism?



- A The organism is a eukaryote.
- B The organism is unicellular.
- C The organism's cells do not contain organelles.
- D The organism's cells do not contain genetic information.

3. If you were to conduct an investigation to determine if an organism is a plant or an animal, which characteristic could be used to distinguish between the two?
- A whether the organism is unicellular or multicellular
 - B whether or not the organism is made of cells
 - C whether or not the organism responds to its environment
 - D whether the organism makes its own food or takes in food
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4. Which should NOT be included in a model developed to show differences between unicellular and multicellular organisms?
- A Unicellular organisms have fewer cells than multicellular organisms.
 - B Unicellular organisms are larger than multicellular organisms.
 - C Unicellular organisms are organized differently than multicellular organisms.
 - D Unicellular organisms are smaller than multicellular organisms.

5. **Construct an Argument** Your friend thinks that studying cells is a waste of time. He says, "Cells are so small, most of them can't even be seen without a microscope. So why waste your time focusing on researching things you can't even see?!" Construct an argument detailing the importance of studying cells and how it can affect your friend's life.

Answers may vary. Sample answer: Our bodies are made of cells, so it is important for people like doctors to understand how cells work. People also study cells of other organisms so they can learn more about how to prevent those organisms from making us sick.

6.  **ENGINEERING Connection** Using what you've learned in this lesson, explain how science is dependent on advances in engineering and technology.

Answers may vary. Sample answer: Engineering and technology advances, such as microscopes, have allowed us to have a deeper scientific understanding about living things. Without these advancements, we might not know all living things are made of cells, or know about the different parts and types of cells.

Analyze and Conclude

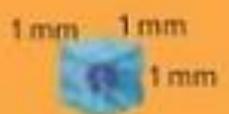
5. If the wire mesh in this model represents the cell membrane, how do you think the cell membrane controls what materials enter and leave a cell?

Answers may vary. Sample answer: The cell membrane has small openings, like the wire mesh. Materials that are small enough to fit through the openings can enter or leave the cell. Materials that are too large cannot enter or leave a cell.

ASK: What structure surrounds the cytoplasm of plant and animal cells? **cell membrane**

ASK: What structure encloses the cell membrane of a plant cell? **cell wall**

3. Fill in the missing parts of the table in the blue boxes below.

		
Length	1 mm	4 mm
Width	1 mm	4 mm
Height	1 mm	4 mm
Number of Sides	6	6
Surface Area ($l \times w \times \text{no. of sides}$)	$1 \text{ mm} \times 1 \text{ mm} \times 6$ $= 6 \text{ mm}^2$	$4 \text{ mm} \times 4 \text{ mm} \times 6$ $= 96 \text{ mm}^2$
Volume ($l \times w \times h$)	$1 \text{ mm} \times 1 \text{ mm} \times 1 \text{ mm}$ $= 1 \text{ mm}^3$	$4 \text{ mm} \times 4 \text{ mm} \times 4 \text{ mm}$ $= 64 \text{ mm}^3$
Surface-area-to-volume ratio	$\frac{6 \text{ mm}^2}{1 \text{ mm}^3} = \frac{6}{1}$ or 6 : 1	$\frac{96 \text{ mm}^2}{64 \text{ mm}^3} = \frac{1.5}{1}$ or 1.5 : 1

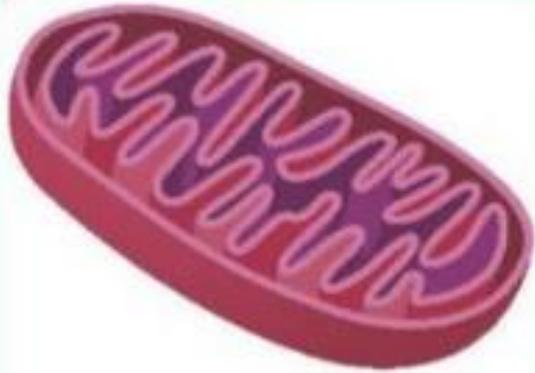
4. Would a cell with a small surface-area-to-volume ratio be able to transport nutrients and waste through the cell as efficiently as a cell with a large surface-area-to-volume ratio? Explain why or why not.

Sample answer: The cell with a small surface-area-to-volume ratio would not be able to transport materials as efficiently as a cell with a large surface-area-to-volume ratio. In the demonstration, the dye moved farther into the smaller cube because it had a larger surface area to transport materials through compared to its volume.

ASK: What is the relationship between Golgi apparatus and vesicles? **The Golgi apparatus packages proteins into small structures called vesicles.**

ASK: Chloroplasts are green. What kinds of organisms do you think they might be found in? **Answers may vary, but students should connect that chloroplasts are found in plants and other organisms, such as algae, that are green in color.**

Powering a Cell



What do you notice about the two organelles to the left?
What are their differences, and what are their similarities?
Can you infer what their functions are?

_____ : They have similar
shapes. Maybe they process food for the
cell.

ASK: What organelle controls the cell's activities? **the nucleus**

ASK: What is the relationship between DNA and chromosomes?
Sample answers: DNA is organized into structures called chromosomes; DNA makes up chromosomes.

ASK: What is the dark structure shown in the center of the nucleus? **the nucleolus**

ASK: What are some differences between plant and animal cells? **Plant cells have a cell wall, but animal cells do not.**



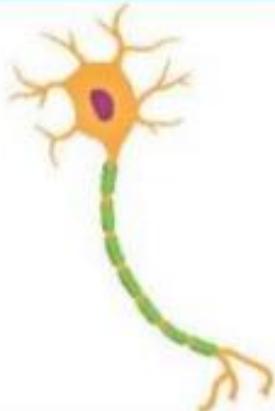
The **structure** of a cell relates to its job, or **function**. Use the table below to infer a cell's function based on its shape.



Red blood cell: The red color, in addition to the small size and disk shape, leads me to believe that these cells are related to blood.



Trachea: The tube shape makes me think that this cell carries something.



Neuron: The net-like head has many tendrils, which may connect to other cells. This may carry information.

ASK: How many cells make up a *Vorticella* organism? **one**

ASK: What are some functions a unicellular organism needs to carry out? **Sample answers: getting food, getting rid of wastes, responding to the environment**

After You Read

ASK: What are some specific structures that can be observed when looking at *Vorticella*? **Sample answers: cilia, stalk**

ASK: What are the functions of these structures? **Sample answer: The cilia bring food toward the cell; the stalk allows the cell to latch onto surfaces.**

Organelle	Function	Plant, animal, or both?
Nucleus	Directs cellular activity	Both
Mitochondria	Power animal cells and plant cells	Both
Chloroplasts	Capture energy for the plant cell	Plant
Cell Wall	Provides structure, support, and protection	Plant
Cell Membrane	Regulates what enters and leaves a cell	Both



Three-Dimensional Thinking

2. Rosa is planning an investigation using a microscope to try to identify a group of cells. She sees that the cells are joined together, so she knows that they are from one organism. If she also sees that all of the cells have cells walls, Rosa can conclude that she could be looking at
- A bacterial cells.
 - B human cells.
 - C mouse cells.
 - D plant cells.
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3. Mitochondria function as subsystems within the larger system of the cell as a whole. Which explains why a mitochondrion, shown below, is known as the “power house” of a cell?



- A It converts energy in food to ATP.
- B It helps the cell gather sunlight.
- C The cell eats it as food.
- D It has two membranes.

4. **MATH Connection** Which statement could you use to construct an explanation for why it is important for a cell's surface-area-to-volume ratio to not be too small?
- A** Wastes and nutrients need to move through the membrane.
 - B** If a cell's surface-area-to-volume ratio was too small, the cell would starve.
 - C** If a cell's surface-area-to-volume ratio was too small, the cell would not produce enough waste material.
 - D** If a cell's surface-area-to-volume ratio was too small, the organelles would grow too large to fit within the cell.

5. **Infer** Suppose that you are a scientist and you have been given a sample of unknown cells. By looking at the cells under a microscope, what would you be able to determine about the organisms the cells came from? Explain your reasoning.

: By looking at the cells under a microscope, I would be able to infer what kind of organism the cells came from. I could see if the cells had cell walls, and if so, I could infer they came from a plant, fungus, bacteria or protist. If the cells had chloroplasts, I could infer that they were either from a plant or were a protist.

6. **Explain** Your friend is making a model of a cell and wants to use metal to represent the cell membrane because metal is solid and would allow nothing to enter or leave the cell. Explain why you agree or disagree with his reasoning.

: I disagree because cell membranes are flexible and allow certain materials to enter and leave cells.