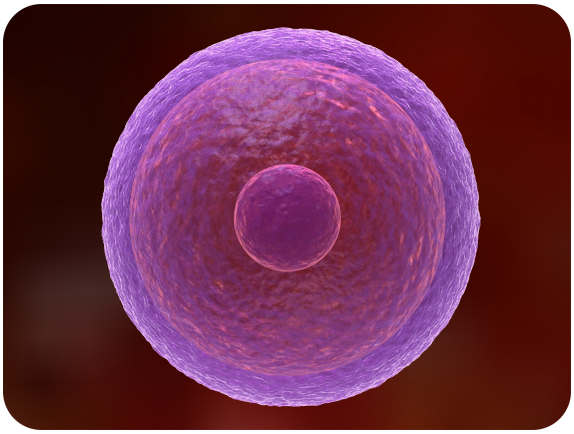
Chapter 3

Cellular Structure and Function Worksheets



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- **Lesson 3.1: Introduction to Cells**
- **Lesson 3.2: Cell Structures**
- **Lesson 3.3: Cell Transport and Homeostasis**

3.1 Introduction to Cells

Lesson 3.1: True or False

Name_____ **Class**_____ **Date**_____

Write true if the statement is true or false if the statement is false.

_____ 1. All organisms are made of more than one cell.

_____ 2. Early microscopes created by Leeuwenhoek were almost as strong as modern light microscopes.

_____ 3. Proteins are made on ribosomes.

_____ 4. Prokaryotic cells have a nucleus.

_____ 5. The plasma membrane forms the physical boundary between the cell and its environment.

_____ 6. For cells, a smaller size is more efficient.

_____ 7. Compared to eukaryotic cells, prokaryotic cells are very complex.

_____ 8. Organelles are located within the cytoplasm.

_____ 9. Viruses are similar to prokaryotic cells.

_____ 10. All cells have a plasma membrane, cytoplasm, and ribosomes.

_____ 11. DNA is located in the nucleus of prokaryotic cells.

_____ 12. Organelles allow eukaryotic cells to carry out more functions than prokaryotic cells.

_____ 13. Viruses are considered living organisms.

_____ 14. Most cells are about the size of the period at the end of this sentence.

_____ 15. Observation of cork helped in the discovery of cells.

Lesson 3.1: Critical Reading

Name_____ **Class**_____ **Date**_____

Read these passages from the text and answer the questions that follow.

Two Types of Cells

There is another basic cell structure that is present in many but not all living cells: the nucleus. The **nucleus** of a cell is a structure in the cytoplasm that is surrounded by a membrane (the nuclear membrane) and contains DNA. Based on whether they have a nucleus, there are two basic types of cells: prokaryotic cells and eukaryotic cells.

Prokaryotic Cells

Prokaryotic cells are cells without a nucleus. The DNA in prokaryotic cells is in the cytoplasm rather than enclosed within a nuclear membrane. Prokaryotic cells are found in single-celled organisms, such as bacteria. Organisms with prokaryotic cells are called **prokaryotes**. They were the first type of organisms to evolve and are still the most common organisms today.

Eukaryotic Cells

Eukaryotic cells are cells that contain a nucleus. Eukaryotic cells are usually larger than prokaryotic cells, and they are found mainly in multicellular organisms. Organisms with eukaryotic cells are called eukaryotes, and they range from fungi to people. Eukaryotic cells also contain other organelles besides the nucleus. An **organelle** is a structure within the cytoplasm that performs a specific job in the cell. Organelles called mitochondria, for example, provide energy to the cell, and organelles called vacuoles store substances in the cell. Organelles allow eukaryotic cells to carry out more functions than prokaryotic cells can.

Viruses: Prokaryotes or Eukaryotes?

Viruses are tiny particles that may cause disease. Human diseases caused by viruses include the common cold and flu. Do you think viruses are prokaryotes or eukaryotes? The answer may surprise you. Viruses are not cells at all, so they are neither prokaryotes nor eukaryotes.

Viruses contain DNA but not much else. They lack the other parts shared by all cells, including a plasma membrane, cytoplasm, and ribosomes. Therefore, viruses are not cells, but are they alive? All living things not only have cells; they are also capable of reproduction. Viruses cannot reproduce by themselves. Instead, they infect living hosts, and use the hosts' cells to make copies of their own DNA. For these reasons, most scientists do not consider viruses to be living things.

Questions

1. What is one main difference between prokaryotic and eukaryotic cells?

2. Give an example of a prokaryotic organism.

3. What is an organelle? Give three examples. (*Hint: See the Eukaryotic Cell figure in the FlexBook.*)

4. Describe the nucleus. What can be found inside the nucleus?

5. Are viruses alive? Discuss why or why not.

Lesson 3.1: Multiple Choice

Name_____ **Class**_____ **Date**_____

Circle the letter of the correct choice.

1. Organelles in prokaryotic cells include the
   (a) mitochondria.
   (b) cytoskeleton.
   (c) Golgi complex.
   (d) none of the above
2. A major difference between prokaryotic and eukaryotic cells is that
   (a) prokaryotic cells have a flagellum.
   (b) eukaryotic cells have a nucleus.
   (c) prokaryotic cells have cytoplasm.
   (d) eukaryotic cells have ribosomes.
3. Robert Hooke was the first person to observe cells. He observed these cells in
   (a) a piece of cork.
   (b) a slice of honeycomb.
   (c) human blood.
   (d) plaque from his own teeth.
4. Cell size is limited by the
   (a) amount of cytoplasm.
   (b) cell's ability to get rid of wastes.
   (c) the size of the nucleus.
   (d) the size of the plasma membrane.
5. The spikes on pollen grains probably
   (a) allow the pollen grain to stick to insects.
   (b) allow the pollen grain to fly through the air.
   (c) protect the pollen grain from being eaten.
   (d) allow insects to stick to the pollen grain.
6. All cells have the following:
   (a) plasma membrane, cytoplasm, and ribosomes.
   (b) plasma membrane, nucleus, and DNA.
   (c) DNA, ribosomes, and cell wall.
   (d) plasma membrane, cytoplasm, and nucleus.
7. The first microscopes were made around
   (a) 1965.
   (b) 1665.
   (c) 1950.
   (d) 1776.
8. The cell theory states that
   (a) all organisms are made of one or more cells.
   (b) all cells come from already existing cells.
   (c) all the life functions of organisms occur within cells.
   (d) all of the above

Lesson 3.1: Vocabulary I

Name_____ **Class**_____ **Date**_____

Match the vocabulary word with the proper definition.

Definitions

_____ 1. organism that has cells containing a nucleus and other organelles

_____ 2. an organelle inside eukaryotic cells where the DNA is located

_____ 3. cell without a nucleus

_____ 4. a structure within the cytoplasm of a cell that is enclosed within a membrane and performs a specific job

_____ 5. phospholipid bilayer that surrounds and encloses a cell

_____ 6. first person to use the word "cell"

_____ 7. tiny, non-living particles that may cause disease

_____ 8. the material inside the plasma membrane of a cell

_____ 9. cell that contains a nucleus and other organelles

_____ 10. organelle where proteins are made

_____ 11. discovered human blood cells

_____ 12. a single-celled organism that lacks a nucleus

Terms

a. Anton van Leeuwenhoek

b. cytoplasm

c. eukaryote

d. eukaryotic cell

e. nucleus

f. organelle

g. plasma membrane

h. prokaryote

i. prokaryotic cell

j. ribosome

k. Robert Hooke

l. virus

Lesson 3.1: Vocabulary II

Name_____ **Class**_____ **Date**_____

Fill in the blanks with the appropriate term.

1. All organisms are made up of one or more _____.
2. All cells have certain parts in common, including a plasma membrane, _____, _____-_____, and DNA.
3. Proteins are made on the _____.
4. A _____ is a typical prokaryotic cell.
5. _____ cells are usually larger than _____ cells.
6. Leeuwenhoek discovered _____ by looking at the plaque from his own teeth.
7. _____ contain DNA, but do not contain cytoplasm or ribosomes.
8. In an eukaryotic cell, DNA is found in the _____.
9. _____ is the genetic instructions that cells need to make proteins.
10. The plasma membrane is a bilayer of _____ that surrounds a cell.
11. A cell's shape is generally related to the cell's _____.
12. _____ are cells without a nucleus.

Lesson 3.1: Critical Writing

Name_____ **Class**_____ **Date**_____

Thoroughly answer the question below. Use appropriate academic vocabulary and clear and complete sentences.

Compare and contrast eukaryotic cells with prokaryotic cells. Include at least 5 specific similarities and/or differences.

3.2 Cell Structures

Lesson 3.2: True or False

Name_____ **Class**_____ **Date**_____

Write true if the statement is true or false if the statement is false.

_____ 1. The water-hating hydrophobic tails of the phospholipid bilayer face the outside of the cell membrane.

_____ 2. The cytoplasm essentially acts as a "skeleton" inside the cell.

_____ 3. Roundworms have organ system-level organization, in which groups of organs work together to do a specific job.

_____ 4. Plant cells have special structures that are not found in animal cells, including a cell membrane, a large central vacuole, and plastids.

_____ 5. Centrioles help organize chromosomes before cell division.

_____ 6. Ribosomes can be found attached to the endoplasmic reticulum.

_____ 7. ATP is made in the mitochondria.

_____ 8. Many of the biochemical reactions of the cell occur in the cytoplasm.

_____ 9. Animal cells have chloroplasts, organelles that capture light energy from the sun and use it to make food.

_____ 10. Small hydrophobic molecules can easily pass through the plasma membrane.

_____ 11. In cell-level organization, different cells are specialized for different functions.

_____ 12. The flagella on your lung cells sweep foreign particles and mucus toward the mouth and nose.

_____ 13. Mitochondria contains its own DNA.

_____ 14. The plasma membrane is a single phospholipid layer that supports and protects a cell and controls what enters and leaves it.

_____ 15. The cytoskeleton is made from thread-like filaments and tubules.

Lesson 3.2: Critical Reading

Name_____ **Class**_____ **Date**_____

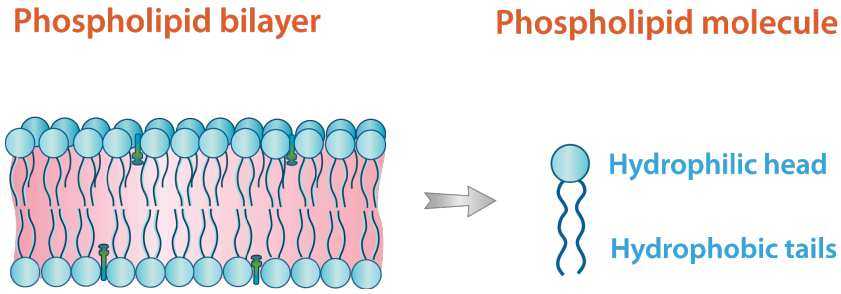
Read these passages from the text and answer the questions that follow.

Plasma Membrane

The plasma membrane forms a barrier between the cytoplasm inside the cell and the environment outside the cell. It protects and supports the cell and also controls everything that enters and leaves the cell. It allows only certain substances to pass through, while keeping others in or out. The ability to allow only certain molecules in or out of the cell is referred to as selective permeability or semipermeability. To understand how the plasma membrane controls what crosses into or out of the cell, you need to know its composition.

Phospholipid Bilayer

The plasma membrane is composed mainly of phospholipids, which consist of fatty acids and alcohol. The phospholipids in the plasma membrane are arranged in two layers, called a phospholipid bilayer. As shown in the figure below, each phospholipid molecule has a head and two tails. The head "loves" water (hydrophilic) and the tails "hate" water (hydrophobic). The water-hating tails are on the interior of the membrane, whereas the water-loving heads point outwards, toward either the cytoplasm or the fluid that surrounds the cell. Molecules that are hydrophobic can easily pass through the plasma membrane, if they are small enough, because they are water-hating like the interior of the membrane. Molecules that are hydrophilic, on the other hand, cannot pass through the plasma membrane — at least not without help — because they are water-loving like the exterior of the membrane.



The phospholipid bilayer consists of two layers of phospholipids (left), with a hydrophobic, or water-hating, interior and a hydrophilic, or water-loving, exterior. A single phospholipid molecule is depicted on the right. *(Image courtesy of CK-12 Foundation and under the Creative Commons license CC-BY-NC-SA 3.0.)*

Other Molecules in the Plasma Membrane

The plasma membrane also contains other molecules, primarily other lipids and proteins. The green molecules in the figure above, for example, are the lipid cholesterol. Molecules of cholesterol help the plasma membrane keep its shape. Many of the proteins in the plasma membrane assist other substances in crossing the membrane.

Extensions of the Plasma Membrane

The plasma membrane may have extensions, such as whip-like flagella or brush-like cilia. In single-celled organisms, the membrane extensions may help the organisms move. In multicellular organisms, the extensions have other functions. For example, the cilia on human lung cells sweep foreign particles and mucus toward the mouth and nose.

Questions

1. What is the plasma membrane?

2. What is the meaning of *semipermeability*?

3. Discuss why the plasma membrane must be a bilayer.

4. What are some of the "other" molecules in the plasma membrane? Describe their function.

5. What are cilia and flagella?

Lesson 3.2: Multiple Choice

Name_____ **Class**_____ **Date**_____

Circle the letter of the correct choice.

1. The "power plant" of the cell is the
   (a) nucleus.
   (b) ribosome.
   (c) chloroplast.
   (d) mitochondria.
2. Which organelle ensures that after cell division each daughter cell has the correct number of chromosomes?
   (a) the nucleus
   (b) the endoplasmic reticulum
   (c) the centriole
   (d) the cytoskeleton
3. Structures specific in plant cells but not in animal cells include
   (a) a large central vacuole.
   (b) the mitochondria.
   (c) the cell membrane.
   (d) the cytoplasts.
4. Having tissues that digest food, such as in the jellyfish, is an example of
   (a) cell-level organization.
   (b) tissue-level organization.
   (c) organ-level organization.
   (d) organ system-level organization.
5. The plasma membrane contains which of the following?
   (a) phospholipids
   (b) cholesterol molecules
   (c) many proteins
   (d) all of the above
6. Which of the following is true of the nucleus?
   (a) The nucleus is considered the control center of the cell.
   (b) The nucleus contains all the cell's DNA.
   (c) All cells have a nucleus.
   (d) all of the above
7. Which structure determines what molecules can enter and leave the cell?
   (a) the plasma membrane
   (b) the cell wall
   (c) the nucleus
   (d) all of the above
8. Which organelle may have allowed early eukaryotes to make food and produce oxygen?
   (a) the Golgi apparatus
   (b) the central vacuole
   (c) the plastids

(d) the cell wall

Lesson 3.2: Vocabulary I

Name_____ **Class**_____ **Date**_____

Match the vocabulary word with the proper definition.

Definitions

_____ 1. the arrangement of phospholipids in the plasma membrane

_____ 2. helps make and transport proteins and lipids

_____ 3. stores and transports protein and lipid molecules

_____ 4. helps the cell maintain its shape and holds cell organelles in place within the cytoplasm

_____ 5. layer that surrounds the plasma membrane of a plant cell

_____ 6. help organize the chromosomes before cell division

_____ 7. organelle that processes proteins and prepares them for use both inside and outside the cell

_____ 8. larger of the sac-like organelles that store and transport materials in the cell

_____ 9. describes the formation of eukaryotic cells

_____ 10. energy-carrying molecule

_____ 11. stores substances such as water, enzymes, and salts in plant cells

_____ 12. "power plant" of the cell

Terms

a. ATP

b. cell wall

c. central vacuole

d. centriole

e. cytoskeleton

f. endoplasmic reticulum

g. endosymbiotic theory

h. Golgi apparatus

i. mitochondria

j. phospholipid bilayer

k. vacuole

l. vesicle

Lesson 3.2: Vocabulary II

Name_____ **Class**_____ **Date**_____

Fill in the blank with the appropriate term.

1. The _____ is often considered to be the cell's control center.
2. The _____ consists of everything inside the plasma membrane of the cell.
3. The plasma membrane forms a _____ between the inside and outside of the cell.
4. The _____ is essentially a "skeleton" inside the cell.
5. The rough endoplasmic reticulum is covered with _____.
6. Lysosomes use _____ to break down foreign matter and dead cells.
7. _____ cells specifically have a cell wall, a large central vacuole, and chloroplasts.
8. The endoplasmic reticulum is an organelle that helps make and transport _____ and lipids.
9. Mitochondria are sometimes referred to as the _____ of the cell
10. Human beings have _____-level organization, in which groups of organs work together to do a certain job.
11. Centrioles help make sure each daughter cell has the correct number of _____ after the cell divides.
12. Cilia and _____ are extensions of the plasma membrane of many cells.

Lesson 3.2: Critical Writing

Name_____ **Class**_____ **Date**_____

Thoroughly answer the question below. Use appropriate academic vocabulary and clear and complete sentences.

Discuss the properties of the plasma membrane that allow it to act as a barrier around the cell. Include the specifics of the phospholipid bilayer.

3.3 Cell Transport and Homeostasis

Lesson 3.3: True or False

Name_____ **Class**_____ **Date**_____

Write true if the statement is true or false if the statement is false.

_____ 1. Passive transport needs energy.

_____ 2. Active transport needs energy.

_____ 3. Carrier proteins change shape when they transport substances.

_____ 4. Diffusion does not require any help from other molecules.

_____ 5. Facilitated diffusion does not require any help from other molecules.

_____ 6. Endocytosis removes large molecules from the cell.

_____ 7. In diffusion, substances move from an area of lower concentration to an area of higher concentration.

_____ 8. The sodium-potassium pump is a type of channel protein.

_____ 9. Ions can easily flow through a carrier protein.

_____ 10. Diffusion is the osmosis of water.

_____ 11. Endocytosis and exocytosis are types of vesicle transport.

_____ 12. Channel proteins form small "holes" in the plasma membrane.

_____ 13. Transport of substances across the cell membrane helps maintain homeostasis by keeping the cell's conditions within normal ranges.

_____ 14. Channel proteins and carrier proteins are both transport proteins.

_____ 15. The plasma membrane controls what enters and leaves the cell.

Lesson 3.3: Critical Reading

Name_____ **Class**_____ **Date**_____

Read these passages from the text and answer the questions that follow.

Passive Transport

Passive transport occurs when substances cross the plasma membrane without any input of energy from the cell. No energy is needed because the substances are moving from an area where they have a higher concentration to an area where they have a lower concentration. Concentration refers to the number of particles of a substance per unit of volume. The more particles of a substance in a given volume, the higher the concentration. A substance always moves from an area where it is more concentrated to an area where it is less concentrated. It's a little like a ball rolling down a hill. It goes by itself without any input of extra energy.

Simple Diffusion

Diffusion is the movement of a substance across a membrane, due to a difference in concentration, without any help from other molecules. The substance simply moves from the side of the membrane where it is more concentrated to the side where it is less concentrated. Substances that can squeeze between the lipid molecules in the plasma membrane by simple diffusion are generally very small, hydrophobic molecules, such as molecules of oxygen and carbon dioxide.

Osmosis

Osmosis is a special type of diffusion — the diffusion of water molecules across a membrane. Like other molecules, water moves from an area of higher concentration to an area of lower concentration. Water moves in or out of a cell until its concentration is the same on both sides of the plasma membrane.

Facilitated Diffusion

Water and many other substances cannot simply diffuse across a membrane. Hydrophilic molecules, charged ions, and relatively large molecules, such as glucose, all need help with diffusion. The help comes from special proteins in the membrane known as **transport proteins**. Diffusion with the help of transport proteins is called **facilitated diffusion**. There are several types of transport proteins, including channel proteins and carrier proteins.

- Channel proteins form pores, or tiny holes, in the membrane. This allows water molecules and small ions to pass through the membrane without coming into contact with the hydrophobic tails of the lipid molecules in the interior of the membrane.
- Carrier proteins bind with specific ions or molecules, and in doing so, they change shape. As carrier proteins change shape, they carry the ions or molecules across the membrane.

Questions

1. Explain why passive transport does not require energy.

2. What is a main difference between diffusion and facilitated diffusion?

3. Describe how simple diffusion proceeds. What kind of molecules can move across the membrane by simple diffusion?

4. How is water transported across the membrane?

5. What are the two types of transport proteins? Describe how they function.

Lesson 3.3: Multiple Choice

Name_____ **Class**_____ **Date**_____

Circle the letter of the correct choice.

1. Controlling what enters and leaves the cell in an important function of the
   (a) nucleus.
   (b) vesicle.
   (c) plasma membrane.
   (d) Golgi apparatus.
2. During diffusion, substances move from an area of _____ concentration to an area of _____ concentration.
   (a) higher, lower
   (b) lower, higher
   (c) higher, equal
   (d) lower, equal
3. A channel protein does which of the following?
   (a) Carries ions or molecules across the membrane.
   (b) Forms tiny holes in the membrane.
   (c) Changes shape as it transports molecules.
   (d) all of the above
4. The sodium-potassium pump
   (a) uses energy to move sodium ions out of the cell and potassium ions into the cell.
   (b) uses energy to move potassium ions out of the cell and sodium ions into the cell.
   (c) moves sodium ions out of the cell and potassium ions into the cell without using energy.
   (d) moves potassium ions out of the cell and sodium ions into the cell without using energy.
5. Osmosis
   (a) is the diffusion of water.
   (b) is the diffusion of water and other small molecules.
   (c) is the diffusion of water and small ions.
   (d) is the diffusion of small molecules and ions.
6. Types of passive transport include which of the following? (1) simple diffusion, (2) osmosis, (3) facilitated diffusion, (4) active transport, and (5) vesicle transport.
   (a) 1 and 2
   (b) 1, 2, and 3
   (c) 4 and 5
   (d) 1, 2, 3, 4, and 5
7. Endocytosis and exocytosis
   (a) are both a type of vesicle transport.
   (b) move very large molecules either in or out of the cell.
   (c) are both a form of active transport.
   (d) all of the above
8. Which of the following needs energy? (1) passive transport, (2) active transport, (3) exocytosis, and (4) osmosis.
   (a) 1 only

(b) 2 only
(c) 2 and 3
(d) 2, 3, and 4

Lesson 3.3: Vocabulary I

Name_____ **Class**_____ **Date**_____

Match the vocabulary word with the proper definition.

Definitions

_____ 1. transport across a membrane without any additional energy requirement

_____ 2. the diffusion of water

_____ 3. type of vesicle transport that moves a substance into the cell

_____ 4. type of vesicle transport that moves a substance out of the cell

_____ 5. special proteins in the membrane that aid diffusion

_____ 6. membrane protein that forms a small hole that allows ions to pass through

_____ 7. an active transport protein

_____ 8. diffusion with the help of transport proteins

_____ 9. the movement of a substance across a membrane without any help from other molecules

_____ 10. the transport of very large molecules, such as proteins

_____ 11. transport across a membrane in which energy is required

Terms

a. active transport

b. channel protein

c. diffusion

d. endocytosis

e. exocytosis

f. facilitated diffusion

g. osmosis

h. passive transport

i. sodium-potassium pump

j. transport protein

k. vesicle transport

Lesson 3.3: Vocabulary II

Name_____ **Class**_____ **Date**_____

Fill in the blank with the appropriate term.

1. By moving substances into and out of cells, _____ , the process of keeping stable conditions inside a cell, is maintained.

2. A _____ protein changes shape as it carries ions or molecules across the membrane.

3. Exocytosis is the type of _____ transport that moves a substance out of the cell.

4. _____ transport is movement across the plasma membrane that does not require an input of energy.

5. The sodium-potassium _____ is involved in the active-transport of ions.

6. Facilitated diffusion needs the help of _____ proteins

7. _____ refers to the number of particles of a substance per unit of volume.

8. _____ is the type of vesicle transport that moves a substance into the cell.

9. Energy for active transport is supplied by molecules of _____.

10. _____ is the diffusion of water.

11. During active transport, a substance is moving from an area of _____ concentration to an area of _____ concentration.

12. Moving molecules in and out of the cell is an important role of the _____.

Lesson 3.3: Critical Writing

Name_____ **Class**_____ **Date**_____

Thoroughly answer the question below. Use appropriate academic vocabulary and clear and complete sentences.

Discuss passive and active transport. Describe the main differences between these two types of transport, and provide examples of each type.