Name _____ **Period** _____

Chapter 4: A Tour of the Cell

Guided Reading Activities

Big idea: Introduction to the cell

Answer the following questions as you read modules 4.1–4.4:

1. A(n) light microscope uses a beam of light to illuminate the specimen.

2. Beginning students usually confuse magnification and resolution. Briefly compare magnification with resolution.
   Magnification is the apparent increase in size of an object, whereas resolution is the ability to distinguish between two points.
3. Which of the following associations is incorrect?

   a. Light microscope; live bacterial cell

   b. TEM; internal cellular structures

   c. SEM; detailed structure of a nucleus

   d. All of the above are correct.

4. Your small intestine absorbs nutrients from the food you eat. Are you able to draw any conclusions about the surface area-to-volume ratios of the cells that line the small intestine? If so, briefly explain your answer.
   The cells that line the small intestine have a high surface area-to-volume ratio. This allows them to maximize absorption of nutrients.
5. A cell's plasma membrane acts as both a boundary and barrier for the cell. Briefly explain how the walls and roof of a home are a good analogy for the plasma membrane.
   It is a good analogy because the walls and roof of your home define the boundary of your home (inside versus outside). They also act as a barrier: They keep what's outside out and what's inside in.

6. Complete the table that compares prokaryotic and eukaryotic cells.

	Eukaryotic cells	Prokaryotic cells
Similarities	Contain cytoplasm, have one or more chromosomes, have ribosomes, and are bounded by a plasma membrane	
Differences	Larger and contains more organelles	Smaller and has fewer organelles
Example(s)	Any human cell	An *E. coli* cell in your small intestine

7. Match the following terms with their description: cell wall, chromosomes, flagella, cytosol, and ribosomes.

   a. Used for movement by certain cells: flagella

   b. Rigid structure that helps maintain bacterial cell shape: cell wall

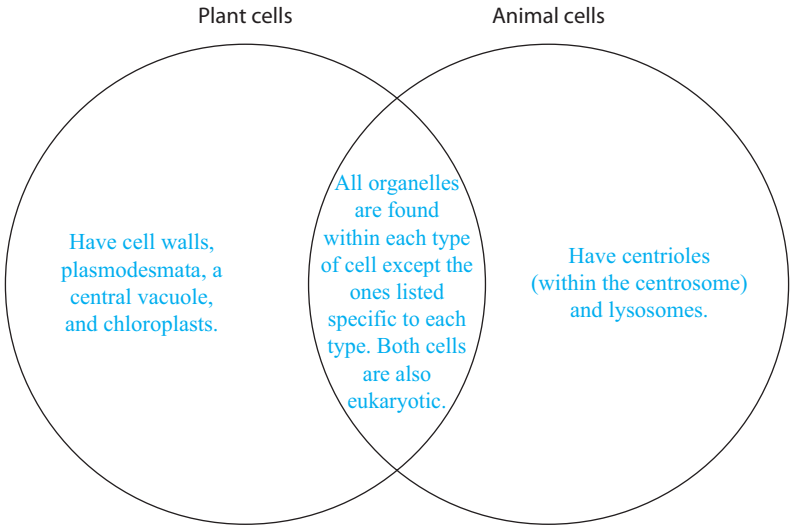
   c. Thick fluid inside cells: cytosol

   d. Structures within cells that assemble proteins: ribosomes

   e. Carry genes: chromosomes

8. List the four basic functional groupings of eukaryotic organelles and structures and give an example within each group.
   (1) Genetic control of the cell: nucleus, (2) manufacture and distribution of molecules within the cell: Golgi apparatus, (3) energy processing: mitochondria, (4) structure: plasma membrane

9. Complete the Venn diagram that compares plant and animal cells.

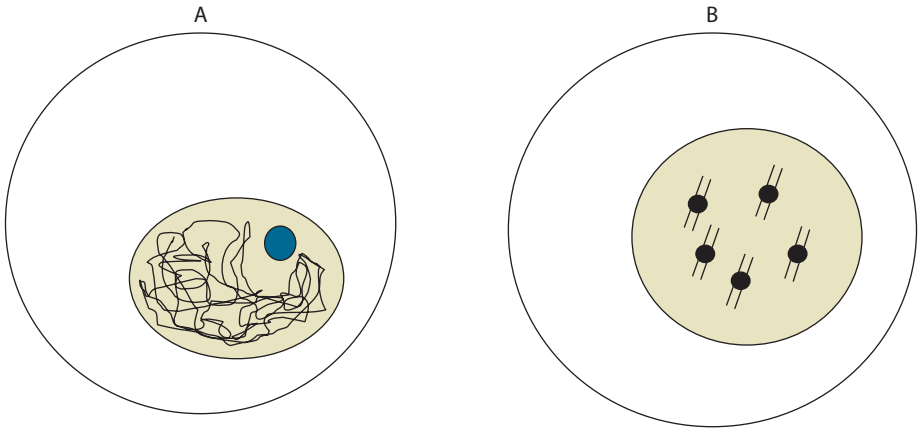


Big idea: The nucleus and ribosomes

Answer the following questions as you read modules 4.5–4.6:

1. DNA and its associated proteins are referred to as chromatin.

2. Which of the following cells would be preparing to divide? Briefly explain your answer.



Cell B is preparing to divide, which is indicated by the chromosomes being replicated and condensed into their visible form.

3. Complete the following table that compares rRNA to mRNA.

	rRNA	mRNA
Role in/part of . . .	Found in ribosomes	Directs protein synthesis
Made in . . .	Nucleolus	Nucleus
Travels to . . .	Cytoplasm	Cytoplasm

4. Briefly describe the relationship between the nucleus and ribosomes. Your answer should include the following key terms: **mRNA**, **rRNA**, and **protein synthesis**.
The nucleus contains the DNA that is copied into an mRNA copy. The rRNA is made within the nucleolus, which is a structure within the nucleus. The rRNA becomes part of a ribosome. The ribosome then uses the mRNA copy to perform protein synthesis.

5. The nuclear envelope has passages for substances moving into and out of the nucleus. These passages are called nuclear pores and they are made by proteins that are inserted into the plasma membrane that makes up the nuclear envelope. These proteins are assembled by which of the following?

   a. Free ribosomes

   b. The nucleus

   c. Bound ribosomes

   d. Nuclear pores

6. You are an evolutionary biologist working for the Smithsonian. On a fossil dig in the Eastern Montana Badlands, you discover fossil evidence that shows early eukaryotic cells containing only free ribosomes. Briefly state what conclusion(s) could be drawn from this evidence.
   You might infer that early eukaryotic cells mostly made proteins that functioned within the cytosol.

Big idea: The endomembrane system

Answer the following questions as you read modules 4.7–4.12:

1. Internal membranes are a distinguishing characteristic of eukaryotic cells.

2. Which of the following cellular components is not part of the endomembrane system?

   a. Vacuoles

   b. Golgi apparatus

   c. Endoplasmic reticulum

   d. Mitochondria

3. The literal translation of endoplasmic reticulum is "within the cytoplasm" and "little net." Briefly explain why endoplasmic reticulum was a good choice of words for naming that organelle. Use Figure 4.5 on page 58 of your textbook to help formulate your answer.
   It was a good choice because the endoplasmic reticulum (ER) covers the nucleus like an extensively folded net. The ER is positioned well to receive genetic information coming from the nucleus.
4. Smooth endoplasmic reticulum (SER) lacks ribosomes, which gives it a "smooth" appearance.

Use the following information to answer questions 5 and 6. The pancreas is an organ that makes and secretes a large amount of different proteins that function as enzymes or hormones.

5. Which type of ER would you expect the cells of the pancreas to have in greater abundance than other cells? Briefly explain your answer.
   You would expect the cells of the pancreas to have a large amount of rough endoplasmic reticulum because it would be making a large amount of proteins for excretion.
6. What other organelle of the endomembrane system would you expect to find in great abundance? Briefly explain your answer.
   You would also expect the pancreas to have an extensive network of Golgi, which would be necessary to ship the enzymes out of the cells of the pancreas.
7. True or false: A protein that is destined to be inserted into the plasma membrane as opposed to being secreted still travels through the Golgi stacks. If false, make it a correct statement.
   True

8. Place the following steps in the order in which they occur:

   a. Proteins are modified as they pass through the Golgi apparatus.

   b. A vesicle from the rough ER fuses with the Golgi membrane.

   c. A vesicle buds off from a Golgi stack.

   d. A vesicle containing a secretory protein fuses with the cell's plasma membrane.
   b, a, c, d

9. Complete the following table that compares components of the endomembrane system.

	Lysosomes	Vacuoles	Vesicles
Function(s)	An organelle that compartmentalizes destructive enzymes and an acidic environment for the breakdown of cellular components	A large structure usually used for storage of different substances that range from toxins to pigments	A small membranous sac that is used for transport

10. _Peroxisomes_ are organelles involved in the metabolism of fatty acids.

11. Internal compartmentalization is crucial to the proper function of a cell. List two organelles where this is important and briefly explain why you chose them.
    Lysosomes because they compartmentalize acids and destructive enzymes; peroxisomes because they make hydrogen peroxide (a toxic substance) as a by-product of their metabolism

Big idea: Energy-converting organelles

Answer the following questions as you read modules 4.13–4.15:

1. Mitochondria are responsible for converting the energy within food to molecules of ATP.

2. True or false: A mitochondrion has three separate phospholipid bilayers. If false, make it a correct statement.
   False, it has two separate plasma membranes.

3. Which of the following is the correct sequence of structures for a mitochondrion, from outside to inside?

   a. Cristae

   b. Outer membrane

   c. Intermembrane space

   d. Matrix

   d, a, c, b

4. Match the following terms to their correct definition: thylakoid, granum, stroma, and chloroplast.

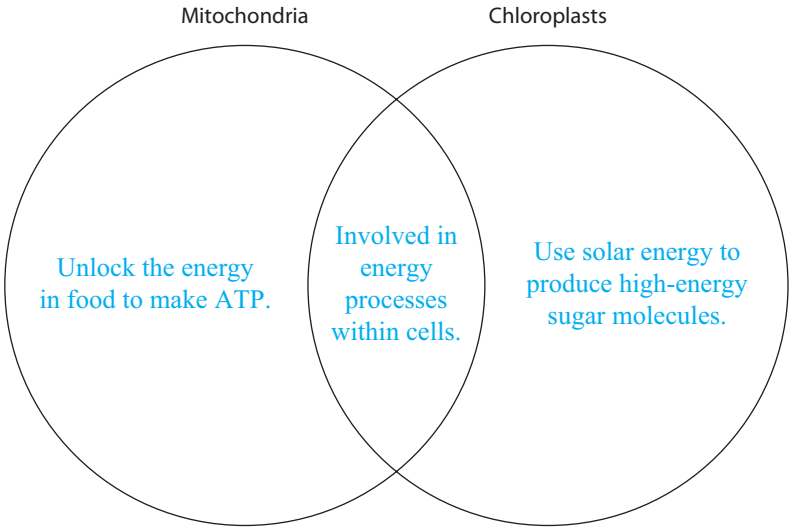
   a. The organelle responsible for performing photosynthesis: chloroplast

   b. A stack of interconnected sacs: granum

   c. Thick fluid found within the inner membrane: stroma

   d. Contain chlorophyll molecules embedded into a membrane: thylakoid

5. Complete the Venn diagram that compares mitochondria to chloroplasts.



6. List three pieces of evidence that suggest mitochondria and chloroplasts evolved from prokaryotic cells.
   Mitochondria and chloroplasts have a singular circular chromosome similar to prokaryotes, they have ribosomes that are similar to prokaryotes, and they reproduce themselves similar to prokaryotes.
7. How many sources of DNA does a typical plant cell contain?

   a. 1

   b. 2

   c. 3

   d. 4

Big idea: The cytoskeleton and cell surfaces

Answer the following questions as you read modules 4.16–4.22:

1. The cytoskeleton refers to a collection of protein fibers that provides structural support to the cell in addition to movement.

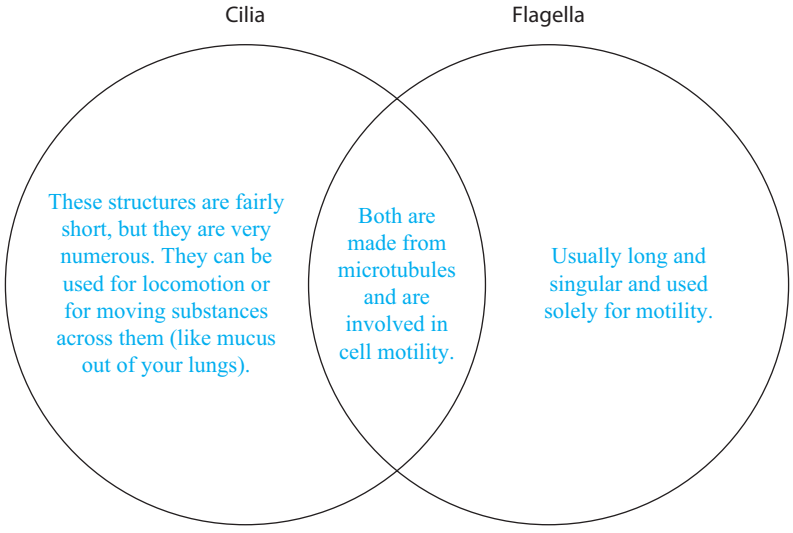
2. Complete the table that compares the different fibers of the cytoskeleton.

	Microtubules	Intermediate filaments	Microfilaments
Function	Serve as tracks for internal cellular transport	Reinforce cell shape	Contraction
Location	Cilia	Outer cells of your skin	Muscle cells
Relative thickness	25 nm	10 nm	7 nm

3. Neurons are very long cells that require the movement of substances from one end of the cell to the other. Which type of cytoskeletal fiber would you expect to find participating in this process?
You would expect them to have a network of microtubles for this transport.

4. Place the following discoveries/technological advances in order: visualization using an electron microscope, isolation of actin and myosin from muscle cells, immunofluorescence, use of a video camera to observe events in real time, molecular cytochemistry, and microscopy used to establish how actin and myosin interact.
Isolation of actin and myosin, microscopy used to establish how actin and myosin interact, visualization using an electron microscope, immunofluorescence, molecular cytochemistry, and use of a video camera in real time

5. Complete the Venn diagram to compare cilia with flagella.



6. Briefly explain how the plasma membrane is supported both internally by elements of the cytoskeleton and externally by the ECM.
Fibrous proteins help to provide structure intracellularly and extracellularly. For example, collagen forms a large portion of the ECM, which helps to protect the cell and holds cells together.

7. Which of the following spans a cell's membrane and allows for signaling between the ECM and cytoskeleton?

   a. Integrins

   b. Glycoproteins

   c. Collagen

   d. Actin

8. True or false: Gap junctions prevent substances from leaking through cell layers. If false, make it a correct statement.
   False, tight junctions prevent substances from leaking through cell layers.

9. Plasmodesmata are connections between plant cells that allow for the passage of water and nutrients.

10. In biology, the relationship between form and function is critical. Briefly explain how this is apparent at the level of the cell. Your answer should include a specific example of how form follows function in a cell.
    Cellular organelles have structures (form) that allow them to perform their function(s) efficiently. For example, lysosomes and peroxisomes are membranous sacs that allow for the compartmentalization of their toxic contents.

CONNECTING THE BIG IDEAS

Use your knowledge of the information contained within this chapter's "Big Ideas" to answer this question.

Certain cells of your immune system respond to certain pathogens by engulfing and digesting these invading cells and/or moving throughout your body tissues. Briefly identify the organelles that are involved, as well as their functions, during these events.

