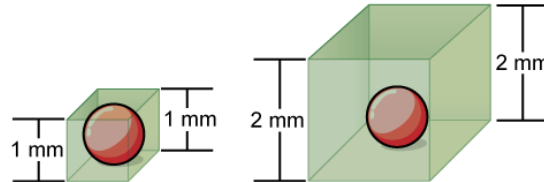


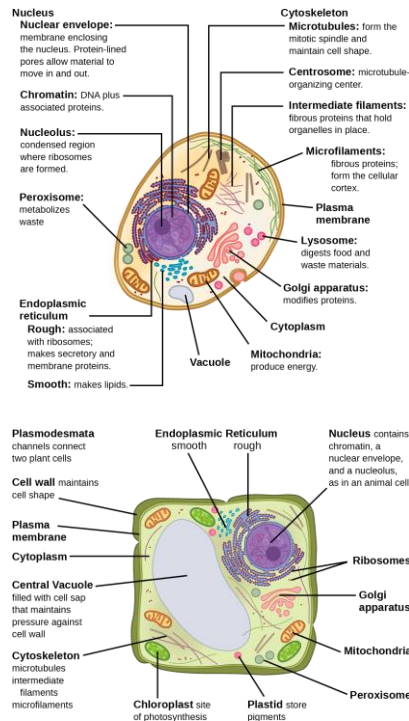
Biology 2e**Unit 2: The Cell****Chapter 4: Cell Structure****Visual Connection Questions**

1. Prokaryotic cells are much smaller than eukaryotic cells. What advantages might small cell size confer on a cell? What advantages might large cell size have?



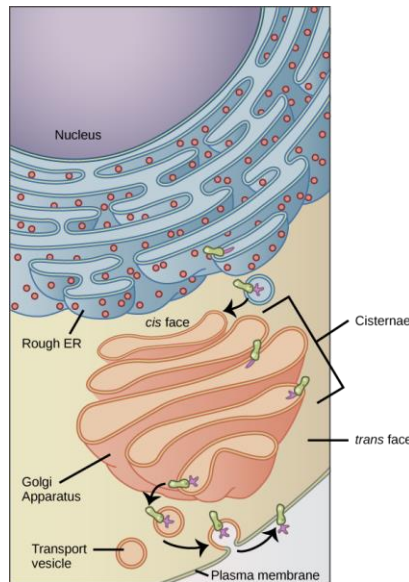
Substances can diffuse more quickly through small cells. Small cells have no need for organelles and therefore do not need to expend energy getting substances across organelle membranes. Large cells have organelles that can separate cellular processes, enabling them to build molecules that are more complex.

2. If the nucleolus were not able to carry out its function, what other cellular organelles would be affected?



Free ribosomes and rough endoplasmic reticulum (which contains ribosomes) would not be able to form.

3. If a peripheral membrane protein were synthesized in the lumen (inside) of the ER, would it end up on the inside or outside of the plasma membrane?



It would end up on the outside. After the vesicle passes through the Golgi apparatus and fuses with the plasma membrane, it turns inside out.

Review Questions

4. When viewing a specimen through a light microscope, scientists use _____ to distinguish the individual components of cells.

c. special stains

5. The _____ is the basic unit of life.

b. cell

6. Prokaryotes depend on _____ to obtain some materials and to get rid of wastes.

d. diffusion

7. Bacteria that lack fimbriae are less likely to _____.

a. adhere to cell surfaces

8. Which of the following organisms is a prokaryote?

d. *E. coli*

9. Which of the following is surrounded by two phospholipid bilayers?

d. the nucleoplasm

10. Peroxisomes got their name because hydrogen peroxide is:

b. produced during their oxidation reactions

11. In plant cells, the function of the lysosomes is carried out by _____.

a. vacuoles

12. Which of the following is both in eukaryotic and prokaryotic cells?

d. ribosomes

13. Tay-Sachs disease is a genetic disorder that results in the destruction of neurons due to a buildup of sphingolipids in the cells. Which organelle is malfunctioning in Tay-Sachs?

a. lysosome

14. Which of the following is not a component of the endomembrane system?

a. mitochondrion

15. The process by which a cell engulfs a foreign particle is known as:

b. phagocytosis

16. Which of the following is most likely to have the greatest concentration of smooth endoplasmic reticulum?

c. a cell that makes steroid hormones

17. Which of the following sequences correctly lists in order the steps involved in the incorporation of a proteinaceous molecule within a cell?

c. synthesis of the protein on the ribosome; modification in the endoplasmic reticulum; tagging in the Golgi; distribution via the vesicle

18. Congenital disorders of glycosylation are a growing class of rare diseases. Which organelle would be most commonly involved in the glycoprotein disorder portion of the group?

d. Golgi apparatus

19. Which of the following have the ability to disassemble and reform quickly?

b. microfilaments and microtubules

20. Which of the following do not play a role in intracellular movement?

d. only intermediate filaments

21. In humans, _____ are used to move a cell within its environment while _____ are used to move the environment relative to the cell.

b. flagella; cilia

22. Which of the following are found only in plant cells?

c. plasmodesmata

23. The key components of desmosomes are cadherins and _____.
c. intermediate filaments

24. Diseased animal cells may produce molecules that activate death cascades to kill the cells in a controlled manner. Why would neighboring healthy cells also die?
d. The death molecule passes through gap junctions.

Critical Thinking Questions

25. In your everyday life, you have probably noticed that certain instruments are ideal for certain situations. For example, you would use a spoon rather than a fork to eat soup because a spoon is shaped for scooping, while soup would slip between the tines of a fork. The use of ideal instruments also applies in science. In what situation(s) would the use of a light microscope be ideal, and why?

A light microscope would be ideal when viewing a small living organism, especially when the cell has been stained to reveal details.

26. In what situation(s) would the use of a scanning electron microscope be ideal, and why?

A scanning electron microscope would be ideal when you want to view the minute details of a cell's surface, because its beam of electrons moves back and forth over the surface to convey the image.

27. In what situation(s) would a transmission electron microscope be ideal, and why?

A transmission electron microscope would be ideal for viewing the cell's internal structures, because many of the internal structures have membranes that are not visible by the light microscope.

28. What are the advantages and disadvantages of each of these types of microscopes?

The advantages of light microscopes are that they are easily obtained, and the light beam does not kill the cells. However, typical light microscopes are somewhat limited in the amount of detail they can reveal. Electron microscopes are ideal because you can view intricate details, but they are bulky and costly, and preparation for the microscopic examination kills the specimen.

29. Explain how the formation of an adult human follows the cell theory.

The cell theory states:

1. All living things are made of cells.
2. Cells are the most basic unit of life.
3. New cells arise from existing cells.

All humans are multicellular organisms whose smallest building blocks are cells. Adult humans begin with the fusion of a male gamete cell with a female gamete cell to form a fertilized egg (single cell). That cell then divides into two cells, which each divides into two more cells, and so forth until all the cells of a human embryo are made. As the embryo passes through all the developmental stages to make an adult human, the cells that are added arise from division of existing cells.

30. Antibiotics are medicines that are used to fight bacterial infections. These medicines kill prokaryotic cells without harming human cells. What part or parts of the bacterial cell do you think antibiotics target? Why?

The cell wall would be targeted by antibiotics as well as the bacteria's ability to replicate. This would inhibit the bacteria's ability to reproduce, and it would compromise its defense mechanisms.

31. Explain why not all microbes are harmful.

Some microbes are beneficial. For instance, *E. coli* bacteria populate the human gut and help break down fiber in the diet. Some foods such as yogurt are formed by bacteria.

32. You already know that ribosomes are abundant in red blood cells. In what other cells of the body would you find them in great abundance? Why?

Ribosomes are abundant in muscle cells as well because muscle cells are constructed of the proteins made by the ribosomes.

33. What are the structural and functional similarities and differences between mitochondria and chloroplasts?

Both are similar in that they are enveloped in a double membrane, both have an intermembrane space, and both make ATP. Both mitochondria and chloroplasts have DNA, and mitochondria have inner folds called cristae and a matrix, while chloroplasts have chlorophyll and accessory pigments in the thylakoids that form stacks (grana) and a stroma.

34. Why are plasma membranes arranged as a bilayer rather than a monolayer?

The plasma membrane is a bilayer because the phospholipids that create it are amphiphilic (hydrophilic head, hydrophobic tail). If the plasma membrane was a monolayer, the hydrophobic tails of the phospholipids would be in direct contact with the inside of the cell. Since the cytoplasm is largely made of water, this interaction would not be stable, and would disrupt the plasma membrane of the cell as the tails were repulsed by the cytoplasm (in water, phospholipids spontaneously form spherical droplets with the hydrophilic heads facing outward to isolate the hydrophobic tails from the water). By having a bilayer, the hydrophilic heads are exposed to the aqueous cytoplasm and extracellular space, while the hydrophobic tails interact with each other in the middle of the membrane.

35. In the context of cell biology, what do we mean by form follows function? What are at least two examples of this concept?

"Form follows function" refers to the idea that the function of a body part dictates the form of that body part. As an example, compare your arm to a bat's wing. While the bones of the two correspond, the parts serve different functions in each organism and their forms have adapted to follow that function.

36. In your opinion, is the nuclear membrane part of the endomembrane system? Why or why not? Defend your answer.

Since the external surface of the nuclear membrane is continuous with the rough endoplasmic reticulum, which is part of the endomembrane system, then it is correct to say that it is part of the system.

37. What are the similarities and differences between the structures of centrioles and flagella? Centrioles and flagella are alike in that they are made up of microtubules. In centrioles, two rings of nine microtubule “triplets” are arranged at right angles to one another. This arrangement does not occur in flagella.

38. How do cilia and flagella differ?

Cilia and flagella are alike in that they are made up of microtubules. Cilia are short, hair-like structures that exist in large numbers and usually cover the entire surface of the plasma membrane. Flagella, in contrast, are long, hair-like structures; when flagella are present, a cell has just one or two.

39. Describe how microfilaments and microtubules are involved in the phagocytosis and destruction of a pathogen by a macrophage.

A macrophage engulfs a pathogen by rearranging its actin microfilaments to bend the plasma membrane around the pathogen. Once the pathogen is sealed in an endosome inside the macrophage, the vesicle is walked along microtubules until it combines with a lysosome to digest the pathogen.

40. Compare and contrast the boundaries that plant, animal, and bacteria cells use to separate themselves from their surrounding environment

All three cell types have a plasma membrane that borders the cytoplasm on its interior side. In animal cells, the exterior side of the plasma membrane is in contact with the extracellular environment. However, in plant and bacteria cells, a cell wall surrounds the outside of the plasma membrane. In plants, the cell wall is made of cellulose, while in bacteria the cell wall is made of peptidoglycan. Gram-negative bacteria also have an additional capsule made of lipopolysaccharides that surrounds their cell wall.

41. How does the structure of a plasmodesma differ from that of a gap junction?

They differ because plant cell walls are rigid. Plasmodesmata, which a plant cell needs for transportation and communication, are able to allow movement of really large molecules. Gap junctions are necessary in animal cells for transportation and communication.

42. Explain how the extracellular matrix functions.

The extracellular matrix functions in support and attachment for animal tissues. It also functions in the healing and growth of the tissue.

43. Pathogenic *E. coli* have recently been shown to degrade tight junction proteins during infection. How would this provide an advantage to the bacteria?

E. coli infections generally cause food poisoning, meaning that the invading bacteria cross from the lumen of the gut into the rest of the body. Tight junctions hold the epithelial layer that lines the digestive tract together so that the material that crosses into the body is tightly regulated. One way *E. coli* can avoid this regulation is to destroy the tight junctions so that it can enter the body between the epithelial cells, rather than having to go through the cells.