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## Part 2 The Cell, the Smallest Unit of Life

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### 3 Cell Structure and Function

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#### I. Chapter Outline

- A. The Cell Theory
  - 1. Microscopy: Reveals Cell Structure
- B. Eukaryotic Cell Boundaries
  - 1. Cell Membrane: Gatekeeper of Cell
  - 2. Cell Wall: Supporter of Plant Cells
- C. Eukaryotic Cell Organelles
  - 1. Nucleus: Controller of Cells
  - 2. Granule-like Organelles
- 3. Membranous Canals and Vacuoles
- 4. Energy-Converting Organelles
- 5. Cytoskeleton: For Shape and Motion
- 6. Centrioles and Other Organelles
- D. Cellular Comparisons
  - 1. Prokaryotic versus Eukaryotic
  - 2. Plant versus Animal

#### II. Chapter Review

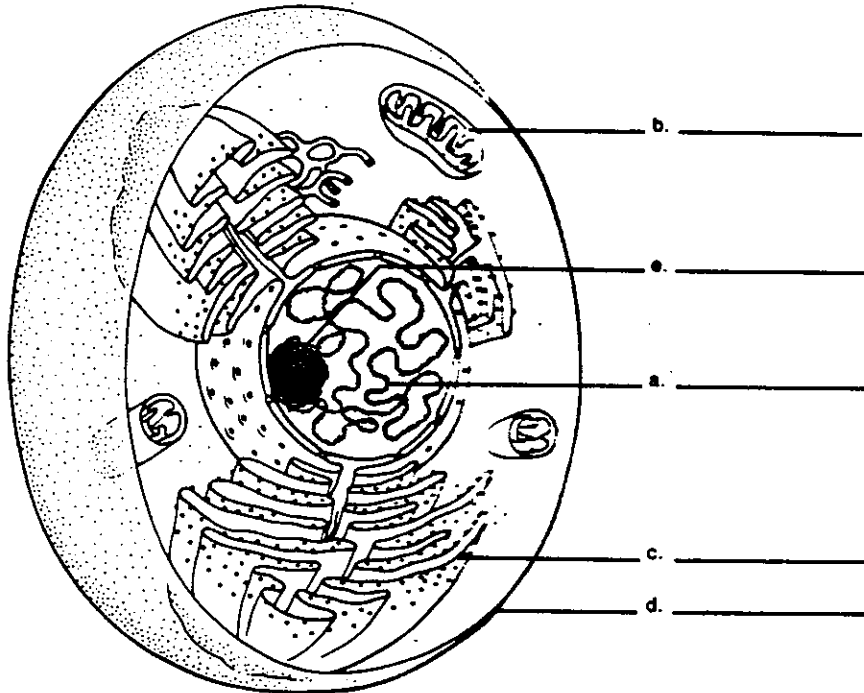
Page	Questions
44	1. Define the cell theory. 2. What is meant by the resolving power of a microscope? 3. Why does an electron microscope have a much greater resolving power than the light microscope?
45	4. List the 2 major chemical components found in plant and animal cell membranes.
46	5. List the major constituent found in the primary and secondary cell walls of plants. 6. Which part of the cell functions as a control center? Which molecule directs protein synthesis? 7. What is the difference between chromatin and chromosomes? 8. What is the role of the nucleoli in the cell?
50	9. _____ are dense granules composed of __ subunits that contain both RNA and _____. They are the sites of _____ synthesis. When several ribosomes are making the same protein, they are arranged in a functional group called a _____. 10. What is the structural difference between rough and smooth endoplasmic reticulum? 11. List 2 functions of smooth endoplasmic reticulum. 12. Ribosomes attached to endoplasmic reticulum produce protein that is destined for _____. 13. How does the ER serve as a transport system? 14. Describe the appearance and give the function of the Golgi apparatus.
51	15. What is the difference between a vacuole and a vesicle? 16. Most vacuoles serve as _____ areas for various kinds of molecules; in plants, the large central vacuole is filled with a watery fluid, which gives added _____ to the cell.
52	17. Lysosomes contain _____ enzymes that digest macromolecules. Why is autodigestion important? 18. List the 2 energy-related organelles of the cell. Which is unique to plants? 19. Describe the structure of mitochondria. Why is it important to the cell? 20. Write the overall equation for aerobic cellular respiration. Do mitochondria use up or give off oxygen? 21. What is the function of chloroplasts, leucoplasts, and chromoplasts? 22. Distinguish between thylakoids, granum, and stroma within a chloroplast.
53	23. Write the overall equation for photosynthesis. 24. What is the function of chlorophyll in the chloroplast? Where is chlorophyll found in the chloroplast? 25. What is the function of a cell's cytoskeleton? 26. Microtubules are composed of the globular protein _____ that can _____ and disassemble. 27. List 2 functions that microtubules are used for in the cell. What controls them?

28. Where are actin microfilaments found within a cell? What are they used for?
- 54 29. Describe the structure of centrioles and give their function.
30. Where are cilia and flagella found? How are they different? What is the function of basal bodies?
31. Describe the microtubular arrangement in cilia and flagella.
- 56 32. List several differences between prokaryotic cells and eukaryotic cells.
33. Give an example of a prokaryotic cell and 2 examples of eukaryotic cells.
- 57 34. What is meant by the endosymbiotic theory?
35. List 3 major differences between plant and animal cells.

### III. Objective Chapter Test

#### *Completion and Short Answer Questions*

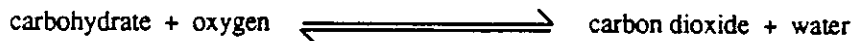
1. Nucleus. The nucleus is enclosed by the (a) \_\_\_\_\_, which contains (b) \_\_\_\_\_ that open into the cytoplasm. At the time of cell division, chromatin (c) \_\_\_\_\_ to form chromosomes. The relationship between the nucleoli and ribosomes is (d) \_\_\_\_\_. DNA within the nucleus controls (e) \_\_\_\_\_.
2. On the lines provided here, name the organelles in this drawing of an animal cell.



3. Which of the following structures (frog egg cell, cell nucleus, endoplasmic reticulum, mitochondria, ribosomes) would be visible
- with the naked eye? \_\_\_\_\_
  - with the compound light microscope? \_\_\_\_\_
  - with the electron microscope? \_\_\_\_\_

4. Chemistry.

- What 2 types of organic molecules are always found within the membrane? \_\_\_\_\_
- Which structure(s) (nucleus, chromosomes, nucleoli, ribosomes) contain DNA? \_\_\_\_\_ RNA? \_\_\_\_\_
- Write the word *mitochondrion* above or below the correct arrow in the equation below. Write the word *chloroplast* above or below the correct arrow.



- What are hydrolytic enzymes, and which organelle contains them? \_\_\_\_\_

5. Place these terms in the appropriate column below: *centrioles, cell membrane, cell wall, large central vacuole, small vacuoles only, mitochondria, chloroplasts, lysosomes, plastids.*

**Animal**

**Plant**

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6. Togetherness. How do these organelles work together?

- lysosomes and vacuoles \_\_\_\_\_
- endoplasmic reticulum and Golgi apparatus \_\_\_\_\_
- centrioles and cilia \_\_\_\_\_
- ribosomes and endoplasmic reticulum \_\_\_\_\_
- chloroplasts and mitochondria \_\_\_\_\_

Matching

- |                                |                    |
|--------------------------------|--------------------|
| ___ 7. packaging and secretion | a. mitochondria    |
| ___ 8. hydrolytic enzymes      | b. ribosomes       |
| ___ 9. energy production       | c. lysosomes       |
| ___ 10. protein synthesis      | d. centrioles      |
| ___ 11. cell division          | e. Golgi apparatus |
| ___ 12. cell motion            | f. cilia           |

13. \_\_\_\_\_ are cylinders composed of thirteen rows of globular proteins, found in multiple units in other organelles such as the centriole, cilia, and flagella.
14. \_\_\_\_\_ is a threadlike network in the nucleus that is made up of DNA and proteins.
15. \_\_\_\_\_ is an organelle in which digestion takes place due to the action of powerful hydrolytic enzymes.
16. The most recently developed microscope that can be used to gain knowledge about cell structure is termed the \_\_\_\_\_.
17. *Matching.* Match the organelles below to this key:  
(1) membranous vacuole (2) energy-related  
(3) centriole-related.

- |                        |                 |
|------------------------|-----------------|
| a. mitochondria ___    | c. cilia ___    |
| b. Golgi apparatus ___ | d. lysosome ___ |

18. What component of the cell membrane causes it to have a consistency of light oil? \_\_\_\_\_  
What component is in the primary cell walls of plants? \_\_\_\_\_
19. The cristae in mitochondria are used for the production of \_\_\_\_\_ by means of \_\_\_\_\_ respiration.

Multiple Choice Questions

20. Plant cells
- a. have a cell wall but no cell membrane.
  - b. have chloroplasts but no mitochondria.
  - c. do not have any centrioles and yet divide.
  - d. have a large central vacuole but do not have endoplasmic reticulum.
21. How are mitochondria like chloroplasts?
- a. They have the same structure.
  - b. They both absorb the energy of the sun.
  - c. They both are concerned with energy.
  - d. They are both in animal cells.
22. Which type of molecule forms a bilayer within the cell membrane?
- a. carbohydrate
  - b. protein
  - c. phospholipid
  - d. nucleic acid
23. Which organelle below does not contain a membrane?
- a. mitochondria
  - b. lysosomes
  - c. Golgi apparatus
  - d. endoplasmic reticulum
  - e. ribosomes
24. Which of these does not contain nucleic acid?
- a. chromosomes
  - b. ribosomes
  - c. chromatin
  - d. centrioles
  - e. genes

25. Which of the following is *not* a difference between prokaryotic cells and eukaryotic cells?

Prokaryotic		Eukaryotic
a. lack a nucleus	—	have a nucleus
b. lack a cell membrane	—	have a cell membrane
c. are smaller	—	are larger
d. are more simple	—	are more complex

26. Which of the following is not true regarding the transmission electron microscope?

- Its maximum useful magnification is about 30,000X.
- It provides an image of the interior of an object.
- It provides a three-dimensional view of the surface of an object.
- It uses electrons to provide for a shorter wavelength to increase resolution.

27. Which of the following cell structures within the cytoplasm is connected to the nuclear envelope?

- the nucleolus
- chromatin
- endoplasmic reticulum
- vacuoles
- lysosomes

28. When secretory products are transported to the cell membrane for export.

- they move enclosed in a vesicle derived from the Golgi apparatus.
- they are still attached to ribosomes.
- they travel directly to the cell membrane through the rough endoplasmic reticulum.
- All of these are correct.

29. Which organelle is used to produce steroid hormones and detoxify drugs?

- lysosomes
- Golgi apparatus
- mitochondria
- rough endoplasmic reticulum
- smooth endoplasmic reticulum

30. Which of the following statements is false?

- Resolving power refers to the capacity to distinguish between 2 adjacent points.
- Electrons have a longer wavelength than visible light.
- A scanning electron microscope provides a three-dimensional view of the surface of an object.
- A scanning-probe microscope can form a three-dimensional picture of a single macromolecule.

#### IV. Subjective Chapter Test

31. A basic concept in biology is that structure and function are intimately related to each other. Give 3 examples of this interrelationship from this chapter.

32. What is the advantage for a cell to have different organelles to carry on different functions?

33. How are mitochondria and chloroplasts interrelated?