

CELL STRUCTURE AND FUNCTION

The study of biology is really the study of living cells. The cell is the unit of structure and function in all living things. Animal and plant cells have both similarities and differences. In Chapters 3 and 4 of your text you will look at the basic structure of cells and how cell design is related to cell function. Audio-Tape 1 will help if you have difficulty with some of the concepts covered in this section.

Types of Cells

1. There are two main groups of cells, the *Plant* and *Animal* cell. List the features of a *Plant* and *Animal* cells and give an example.
(p. 49)

Prokaryotic

Eukaryotic

Example

Cell Organelles

The cell organelles operate together as a unit. In some ways the cell is like a factory, processing all the activities of the cell.

1. Explain how tissue samples are prepared for the light and electron microscope.
(p. 46 and Appendix A1 of the textbook)

Cytoplasm (p. 49)

1. What is the relationship between the cytoplasm and the cell membrane?
2. The cell's cytoplasm is referred to as having a cytoskeleton. What is the composition of this cytoskeleton?

Nucleus

(p. 52)

1. Fig. 3.9 on page 52 shows the nuclear envelope. The white arrows indicate the pores in this double membrane. Observe all the features you can in the photograph and try to hypothesize what the function of the nuclear membrane might be.
2. Why is the nucleolus essential to an animal cell?
3. List the functions of the nucleus, and give some examples.
4. A red blood cell has no nucleus, and has a life expectancy of approximately 120 days. Explain how these two events might be connected?

Nucleoli

(p. 52)

1. Describe its location in the cell.
2. State its function.
3. Ribosomal RNA is produced in the nucleolus. What is its function?

Endoplasmic Reticulum (ER)

(p. 53)

1. Describe the distribution of endoplasmic reticulum within the cell.
2. Fig. 3.9 page 53 is a photomicrograph of the endoplasmic reticulum as it appears under the electron microscope. Notice the granular dots on the tubular canals of the endoplasmic reticulum. We say that this is *rough endoplasmic reticulum* because of its granular look. What is the function of rough endoplasmic reticulum? (pp. 53)

3. *Smooth endoplasmic reticulum* often extends out from rough endoplasmic reticulum. It can be found in many different kinds of cells. List the functions of smooth endoplasmic reticulum. (pp. 53.)
4. Where is smooth ER located in the cell?
5. Why do cells in the testes and adrenal cortex have large amounts of smooth ER?
6. Smooth endoplasmic reticulum has a very large surface area. How is this related to its function?

Ribosomes

(p. 53)

Ribosomes are small, dense granules each containing two sub-units.

1. What is their location in the cell?
2. Describe their chemical composition.
3. What is the specific function of ribosomes?
4. What is the functional difference between attached and unattached ribosomes?
5. Describe the structure of polysomes and their role in the cell.
6. What is the functional relationship between ribosomes and endoplasmic reticulum? (How do they function together as a unit?) (p. 53)

Golgi apparatus

(p. 54)

1. From the diagram in *fig. 3.6 page 54* identify the Golgi apparatus and describe their location in the cell.

2. Describe the physical appearance of Golgi as they appear under the electron microscope. (fig.3.6 p.54)
3. Describe the function of the Golgi apparatus.
4. Fig. 3.6 p.54 illustrates the working relationship between the Golgi apparatus, ribosomes, vesicles and cell membrane. Referring to this diagram, explain how the ER, ribosomes, vesicles, Golgi apparatus and cell membrane operate together.

Vacuoles

(p.54)

1. Describe where vacuoles are located in the cell.
2. What do vacuoles contain?
3. Distinguish between a vacuole and a vesicle.
4. Plant cells have large vacuoles while animal cells have small ones. How does this fact help us understand the role of vacuoles in plant cells?
5. Identify vacuoles in fig. 3.1 a and b, p. 54

Lysosomes

(p.55)

1. Why are lysosomes frequently found near the Golgi apparatus?
2. What do lysosomes contain?
3. List the functions of lysosomes.
4. Describe how lysosome structure is related to its function.

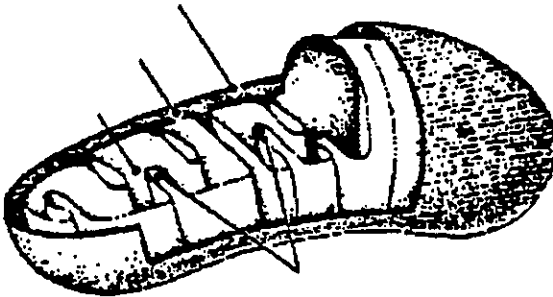
5. Lysosomes are often referred to as "suicide sacs". Explain why.

Mitochondria

(pp. 57)

The mitochondria are extremely efficient organelles which burn glucose products to produce the chemical energy needed by the cells. Mitochondria are essential to the process of cell respiration.

1. From fig. 3.9 on p.57 and the diagrams below, identify the mitochondria's outer membrane, inner membrane, cristae, and matrix.



Simplified drawing of
mitochondrion



photomicrograph of
mitochondrion

2. What is the main function of the mitochondria?
3. Suggest a reason for the cristae being so convoluted.

Chloroplast

(p. 57)

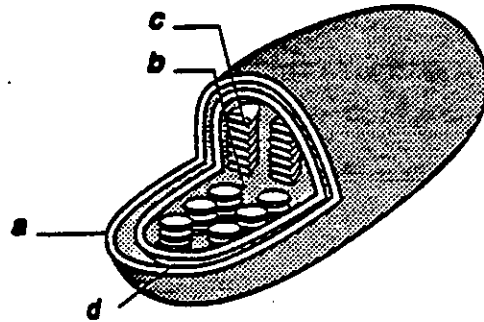
Chloroplasts take in CO_2 , water and light from the sun to produce glucose, and are essential to the process of photosynthesis. Chloroplasts and mitochondria are both *energy-related* organelles.

1. State the function of chloroplasts.

2. Where are they found in the cell?

3. Identify the labeled structures of the chloroplast. (note fig 3.8 p. 56.)

- a. _____
- b. _____
- c. _____
- d. _____



4. Describe the role that each of the following plays in chloroplast function: (p. 57, p. 58)

- a. Grana
- b. Stroma
- c. Lamella
- d. Outer membrane

5. Explain how chloroplasts are designed to capture light.

6. What part of the chloroplast synthesizes glucose?

Microfilaments

(p. 58)

1. Describe their role:

2. Location in the cell:
3. Chemical composition:

Microtubules

(p. 59)

1. Describe their appearance.
2. Name the structures in the cell that have microtubules.
3. Explain how microfilaments and microtubules manipulate cell shape.
4. Be able to identify microtubules and microfilaments from fig. 7.1 p.

Cilia and flagella

(p. 60)

1. Explain how cilia differ from flagella.
2. Describe the structure of the cilia and the pattern of microtubules within the cilia.
3. Explain how cilia and flagella move.

Centrioles

(p. 60)

1. Describe their appearance.
2. Explain the relationship between centrioles and basal bodies.
3. What is the function of basal bodies?

Cell Membrane

1. The cell membrane is well understood in terms of its structure and function. List the main points you would use to describe the Fluid Mosaic model of the cell membrane. (p.68 - p.69) Note: be able to identify Fig. 4.1 p.68 and labelled parts.
2. Why are phospholipids and not lipids found within the membrane?
3. What is the pattern of the proteins within the membrane?
4. In point form, explain the relationship of surface area to volume, with reference to cell size.

Sample Exam Questions

1. Using the following organelles, explain how structure is related to function.
 - a. Ribosomes
 - b. Golgi apparatus
 - c. Lysosomes
 - d. Rough endoplasmic reticulum
 - e. Smooth endoplasmic reticulum
 - f. Mitochondria
2. If the following cell organelles were removed, what function(s) would not occur?
 - a. Ribosome
 - b. Mitochondria
 - c. Lysosomes
 - d. Endoplasmic reticulum
3. Explain the significance of surface area to volume with reference to cells size.
4. Describe the pathway that a protein would take through a cell from the synthesis of the protein to its secretion out of the cell. Include all the organelles that would be involved, in their correct sequence. (Ref 3 - p.55)

5. Identify the following labeled cell parts from the diagram below:

- | | |
|----------|----------|
| a. _____ | e. _____ |
| b. _____ | f. _____ |
| c. _____ | g. _____ |
| d. _____ | |

