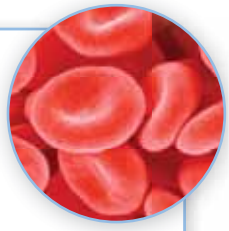
Chapter 1 Summary



1.1 Studying the Structure of Cells

Key Concepts

- Developments in microscopy (microscope technology) have made it possible to look at the internal structures of cells.
- Cells contain a variety of organelles, each of which has its own structure and function. Some organelles are found in all cells, while others are found only in plant cells *or* animal cells.
- Advances in knowledge about cells have helped researchers find new ways to diagnose and treat diseases.

1.2 Genes: Answers and Questions

Key Concepts

- The nucleus of a cell contains chromosomes, which are composed of DNA and divided into segments called genes. Genes control a cell's structure and function by controlling the production of proteins.
- There are many ethical issues related to technological developments in DNA screening, transgenic research, and clinical drug trials. Researchers often make progress faster than society's ability to make decisions about how to use such research.
- Mutations in genes change the structure and function of the proteins in the cells. Many, but not all, genetic mutations are harmful.

1.3 Cells from Cells

Key Concepts

- When single-celled organisms and body cells of animals and plants divide, they form two identical daughter cells. For single-celled organisms, cell division results in population growth. For multicellular organisms, cell division allows individuals to grow and to replace lost or damaged cells.
- Cell division must be preceded by DNA replication so that each daughter cell gets the same genes as its parent.
- Cell division is a continuous process that involves two stages: mitosis, to divide the nucleus, and cytokinesis, to divide the cytoplasm.

1.4 The Cell Cycle

Key Concepts

- Some cells live a long time, while others have a short life span, depending on where in the body they are found and the conditions they endure.
- The life of a cell, called the cell cycle, can be divided into two main stages: cell division and interphase. Interphase consists of two growth stages and a stage of DNA replication.
- Cell division is carefully controlled so that cells are produced only when needed. The control is exerted by proteins at checkpoints in the cell cycle. In cells that accumulate enough mutations, this control can be lost, which may lead to the development of cancer.

Chapter 1 Review

Make Your Own Summary

Summarize the key concepts of this chapter using a graphic organizer. The Chapter Summary on the previous page will help you identify the key concepts. Refer to Study Toolkit 4 on pages 565–566 to help you decide which graphic organizer to use.

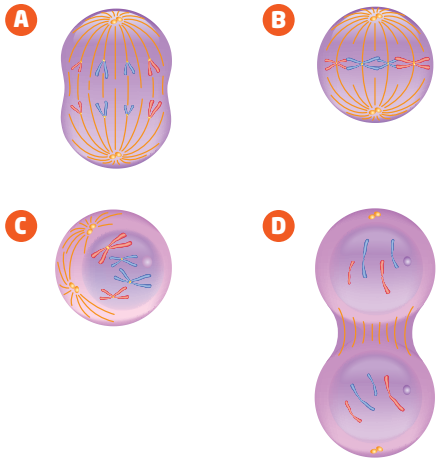
Reviewing Key Terms

Complete each statement below using key terms.

1. The cytoplasm is composed of cytosol and _____. (1.1)
2. A(n) _____ is a photograph taken with a microscope. (1.1)
3. A chromosome consists of a single molecule of _____. (1.2)
4. A change in the usual order of a gene's A, C, T, and G building blocks is called a(n) _____. (1.2)
5. The material in the nucleus divides by a process called _____, whereas the rest of the cell divides by the process of _____. (1.3)
6. The _____ consists of interphase and cell division. (1.4)

Knowledge and Understanding K/U

7. Compare and contrast light microscopes and electron microscopes.
8. How did the invention of the microscope help to improve human health?
9. Describe the relationship between the nucleolus, ribosomes, and proteins.
10. Use a Venn diagram to compare chloroplasts and mitochondria.
11. Why do cells divide?
12. Draw and label a diagram to show metaphase in the process of mitosis. Include spindle fibres, centromeres, and centrosomes in your diagram.
13. What happens during interphase?
14. What is the function of spindle fibres?
15. Use these diagrams to answer the questions below.



   a. Which diagram shows a cell in metaphase?
   b. Which diagram shows a cell with sister chromatids moving to opposite ends of the cell?
   c. Which diagram illustrates a cell in which a new nuclear membrane is forming?
   d. Which diagram shows a cell in anaphase?
   e. Write down the letters of the diagrams in the order in which they occur in mitosis.

16. Create a table that shows the benefits and drawbacks of genetically modified plants.
17. Cells have checkpoints to determine whether cell division should occur. Why are these checkpoints important?
18. Explain the difference between a tumour and cancer.
19. Why is the cell considered to be the basic unit of life?
20. How are the cells in your body identical?

Thinking and Investigation T/I

21. Herbicide-resistant plants are usually selected to resist specific herbicides. Why would it be an advantage for a company to produce both the genetically modified seed and the herbicide? That is, why would a company not necessarily want to develop a seed that would resist all herbicides?

22. Banana growers plant no seeds, yet banana plantations are filled with trees bearing bunches of fruit. How is this possible?

23. The table below shows the number of cells at each of the stages of the cell cycle that a student observed in a slide of a carrot root tip.

Number of Cells in Carrot Root Tip during Stages of the Cell Cycle

Cell Stage	Number of Cells
Interphase	82
Prophase	13
Metaphase	2
Anaphase	2
Telophase	5

a. If you know that it takes 800 min for a full cell cycle to take place, calculate the amount of time spent in each stage of the cell cycle.

Hint: To calculate the amount of time spent in prophase, for example, do the following:

$$\frac{\text{number of cells in prophase}}{\text{total number of cells viewed}} = \frac{\text{time spent in prophase}}{\text{800 min (total time that cycle takes)}}$$

b. Why do you think so much time is spent in interphase?

c. Do you think the cell cycle for a cell in a leaf would be longer or shorter than the cell cycle for the cell in the carrot root tip? Explain your answer.

Communication C

24. BIG IDEAS Developments in medicine and medical technology can have social and ethical implications. Imagine that you are a journalist writing an article for the magazine *Ethics Today*. You have been asked to research and explain the social and ethical implications of a new technology related to medicine or biology. Suggested topics include using transgenic organisms to supply organs for transplant into humans, genetic screening for a specific disease, for-profit companies offering "personal genotyping" services, and cloning.

25. Chemicals that cause cancer are often called carcinogens. Explain the following statement: "All carcinogens are mutagens, but not all mutagens are carcinogens." Pick a particular carcinogen, and produce a pamphlet to educate people about it. Your pamphlet should include information such as what type of products contain it (for example, cleaning products), and what alternatives could be used instead.

26. Make a crossword puzzle that uses the key words from one of the sections of this chapter. Trade with someone who made a crossword puzzle using the key terms from another section, and see if you can solve each other's puzzles.

Application A

27. If a microscope were unavailable, you might be able to detect the existence of a micro-organism by its influence on the environment. Give examples of situations in which you could know that a microscopic organism was present, even if you could not see individuals of this species (that is, if you could not see its cells). Explain why you would know that the organism was there.

28. Your home has internal walls that divide it into rooms, just as most of the organelles inside a cell are separated from the cytoplasm by membranes. Compare the walls of a home with the membranes of organelles. What do they have in common, and what makes them different?

29. Explain why animals and plants are made of billions or trillions of microscopic cells rather than a few large cells.

30. Treatment for bladder cancer often involves chemotherapy, which uses chemicals to attack certain cells. Explain how each of the following methods of chemotherapy will interfere with the rapidly growing cancer cells. Remember what you have learned about the checkpoints in the cell cycle.

a. a chemical that blocks the replication of DNA

b. a chemical that prevents the formation of spindle fibres