

Section 12-5 Gene Regulation (pages 309-312)

Key Concepts

- How are *lac* genes turned off and on?
- How are most eukaryotic genes controlled?

Introduction (page 309)

1. Label the parts of a typical gene in the diagram below.



2. Where does RNA polymerase bind? _____

3. Is the following sentence true or false? The actions of DNA-binding proteins help to determine whether a gene is turned on or turned off. _____

Gene Regulation: An Example (pages 309-310)

4. What is an operon? _____

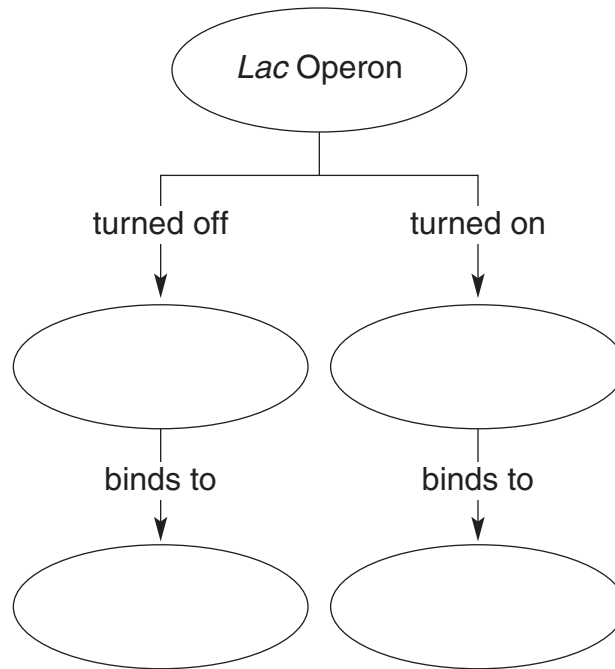
5. What is the function of the genes in the *lac* operon? _____

6. Circle the letter of each sentence that is true about lactose.

- Lactose is a simple sugar.
- To use lactose for food, *E. coli* must take lactose across its cell membrane.
- The bond between glucose and galactose must be broken in order for *E. coli* to use lactose for food.
- Proteins encoded by the genes of the *lac* operon are needed only when *E. coli* is grown on a medium containing glucose.

7. What turns the *lac* operon off and on? _____

8. Complete the concept map to show how the *lac* operon is regulated.



9. How does the repressor protein prevent transcription? _____

10. How does lactose cause the *lac* operon to turn on? _____

11. Circle the letter of each sentence that is true about gene regulation in prokaryotic genes.

- a. The *lac* operon is the only example of genes regulated by repressor proteins.
- b. Many other genes are regulated by repressor proteins.
- c. Some genes are regulated by proteins that enhance the rate of transcription.
- d. Cells cannot turn their genes on and off as needed.

Eukaryotic Gene Regulation (page 311)

12. Is the following sentence true or false? Operons are frequently found in eukaryotes.

13. How are eukaryotic genes usually controlled? _____

14. What is the function of the TATA box? _____

15. Eukaryotic promoters are usually found just _____ the TATA box, and they consist of a series of short _____ sequences.
16. List three ways in which proteins that bind to enhancer sequences of a gene can work to regulate gene expression.
- a. _____
 - b. _____
 - c. _____
17. Why is gene regulation in eukaryotes more complex than in prokaryotes? _____

Development and Differentiation (page 312)

18. What role do the hox genes play in the development of an organism? _____

19. Circle the letter of each sentence that is true about hox genes.
- a. A mutation in a hox gene has no effect on the organs that develop in specific parts of the body.
 - b. In fruit flies, a mutation affecting the hox genes can replace a fly's antennae with a pair of legs.
 - c. The function of the hox genes in humans seems to be almost the same as it is in fruit flies.
 - d. A copy of the gene that controls eye growth in mice does not function in fruit flies.
20. Why do common patterns of genetic control for development exist among animals?

