

Name: _____

AP Biology
Mr. Croft

Chapter 15 Active Reading Guide

Regulation of Gene Expression

The overview for Chapter 15 introduces the idea that while all cells of an organism have all genes in the genome, not all genes are expressed in every cell. What regulates gene expression? Gene expression in prokaryotic cells differs from that in eukaryotic cells. How do disruptions in gene regulation lead to cancer? This chapter gives you a look at how genes are expressed and modulated.

Section 1

1. All genes are not “on” all the time. Using the metabolic needs of *E. coli*, explain why not.
2. What are the two main ways of controlling metabolism in bacterial cells?
3. Feedback inhibition is a recurring mechanism throughout biological systems. In the case of *E. coli* regulating tryptophan synthesis, is it positive or negative inhibition? Explain your choice.
4. What is a promoter?
5. What is the operator? What does it do?
6. What is an operon?

7. List the three components of an operon, and explain the role of each one.

8. How does a repressor protein work?

9. What are regulatory genes?

10. Distinguish between inducible and repressible operons, and describe one example of each type.

11. Draw a sketch of the lac operon with the following terms: operon genes, operon, RNA polymerase, mRNA, repressor protein, operator, repressor, regulatory gene, inducer. Know the function of each structure.

12. Compare and contrast the lac operon and the trp operon.

13. What happens when a repressor is bound to the operator?

14. What is CAP? How does CAP work?
15. Explain why CAP binding and stimulation of gene expression is positive regulation.
16. Describe the relationship between glucose supply, cAMP, and CAP.
17. How can both repressible and inducible operons be negative regulators?

Section 2

18. Even though all cells of an organism have the same genes, there is differential gene expression. What does this mean?
19. What percentage of the genes of a typical human cell is expressed at any given time?
20. What is the common control point of gene expression for all organisms?
21. Gene expression can be regulated by modifications of the chromatin. Distinguish between heterochromatin and euchromatin as to their structure and activity.
22. What occurs in histone acetylation? How does it affect gene expression?

23. What is DNA methylation? What role may it play in gene expression?

24. The inactive mammalian X chromosome is heavily methylated. What is the result of this methylation?

25. What is genomic imprinting, and how is it maintained? Give an example discussed earlier in human genetics.

26. Explain what is meant by epigenetic inheritance, and give an example of epigenetic changes discussed in the text or in class.

27. Explain how enhancers and activators interact with transcription factors to affect gene expression.

28. In prokaryotes, functionally related genes are usually clustered in a single operon. What has been found to be the case in eukaryotes?

29. Operons have not been found in eukaryotic cells, and the genes coding for the enzymes of a particular metabolic pathway are often scattered over different chromosomes. What is a plausible mechanism for the coordination of gene expression?

30. How can alternative RNA splicing result in different proteins derived from the same initial RNA transcript?

31. Posttranscriptional control includes regulation of mRNA degradation. Explain how this affects translation.

32. How can proteins be activated, processed, and degraded? Give an example or describe each process.

Section 3

33. It is now known that much of the RNA that is transcribed is not translated into protein. These RNAs are called noncoding RNAs. Read carefully to discern a crucial role played by these RNAs. What is this role?