**Chapter Review**

**Chapter 9: Transcriptional Regulation and Epigenetics**

9.1

The prototype model for gene regulation in bacteria is the *lac* operon, which is regulated by the binding of a repressor to specific DNA sequences overlapping the promoter. Other bacterial genes are regulated by transcriptional activators, which stimulate rather than inhibit the binding of RNA polymerase to promoters.

9.2

Transcription of eukaryotic genes is controlled by proteins that bind to regulatory sequences, which can be located either near promoters or in distant enhancers. Transcriptional activators are modular proteins, consisting of distinct DNA binding and activation domains. Some repressors interfere with the binding of activators or general transcription factors to DNA; others contain discrete repression domains that inhibit transcription. In addition to regulation at the level of initiation, eukaryotic transcription is regulated at the level of elongation. Many genes have molecules of RNA polymerase II that have initiated transcription but then paused immediately downstream of the promoter, ready to resume transcription in response to appropriate extracellular signals.

9.3

Enzymes that catalyze histone acetylation are associated with transcriptional activators, whereas histone deacetylases are associated with repressors. Histones are also modified by phosphorylation and methylation, and specific modifications of histones affect gene expression by serving as binding sites for other regulatory proteins. Chromatin remodeling factors facilitate the binding of transcription factors to DNA by altering the arrangement or structures of nucleosomes. Histone modifications can be transmitted to daughter cells, providing a major mechanism for epigenetic inheritance. Methylation of cytosine residues inhibits the transcription of eukaryotic genes and is also transmitted to daughter cells. Long noncoding RNAs (lncRNAs) can act as scaffolds by forming complexes with proteins that regulate chromatin modification and recruiting these complexes to their target genes.