**Chapter Overview**

**Chapter 8: RNA Synthesis and Processing**

Chapters 6 and 7 discussed the organization and maintenance of genomic DNA, which can be viewed as the set of genetic instructions governing all cellular activities. These instructions are implemented via the synthesis of RNAs and proteins. Importantly, the behavior of a cell is determined not only by what genes it inherits but also by which of those genes are expressed at any given time. Regulation of gene expression allows cells to adapt to changes in their environments and is responsible for the distinct activities of the multiple differentiated cell types that make up complex plants and animals. Almost all cells in multicellular organisms have the same genomic DNA. Muscle cells and liver cells, for example, contain the same genes; the functions of these cells are determined not by differences in their genomes, but by regulated patterns of gene expression that govern development and differentiation.

The first step in expression of a gene, the transcription of DNA into RNA, is the initial level at which gene expression is regulated in both prokaryotic and eukaryotic cells. RNAs in eukaryotic cells are then modified in various ways—for example, introns are removed by splicing—to convert the primary transcript into its functional form. Different types of RNA play distinct roles in cells: Messenger RNAs (mRNAs) serve as templates for protein synthesis; ribosomal RNAs (rRNAs) and transfer RNAs (tRNAs) function in mRNA translation. Still other noncoding RNAs function in gene regulation, mRNA splicing, rRNA processing, and protein sorting in eukaryotes. In fact, some of the most exciting advances in recent years have pertained to the roles of noncoding RNAs as regulators of gene expression in eukaryotic cells. Transcription and RNA processing are discussed in this chapter. The regulation of transcription is then discussed in Chapter 9 and the final step in gene expression, the translation of mRNA to protein, is the subject of Chapter 10.