**Chapter Review**

**Chapter 11: The Nucleus**

11.1

The nuclear envelope consists of the inner and outer nuclear membranes (which are joined at nuclear pore complexes) and an underlying nuclear lamina. Nuclear pore complexes are large structures that provide the only routes through which molecules can travel between the nucleus and the cytoplasm. Small molecules diffuse freely through the nuclear pore complex, but macromolecules are selectively transported. Proteins destined for import to the nucleus contain nuclear localization signals that are recognized by importins, which direct transport through the nuclear pore complex. Proteins that are transported from the nucleus to the cytoplasm contain nuclear export signals. In most cases, the small GTP-binding protein Ran determines the directionality of transport, although mRNAs are exported by a distinct mechanism. Regulation of nuclear transport provides a mechanism for controlling the activity of nuclear proteins, such as transcription factors.

11.2

Individual chromosomes occupy distinct territories within the nucleus and are divided into large looped domains that function as independent units. Transcriptionally inactive heterochromatin is frequently associated with the nuclear envelope or nucleolus, whereas transcriptionally active chromatin is localized to the interior of the nucleus. DNA replication takes place within large complexes containing multiple replication forks, and transcription occurs at clustered sites that are enriched in RNA polymerases and transcription factors.

11.3

Several types of nuclear bodies compartmentalize the nucleus and serve to concentrate proteins and RNAs involved in a variety of aspects of gene expression. The nucleolus is associated with the genes for ribosomal RNAs and is the site of rRNA transcription, rRNA processing, and ribosome assembly. Polycomb proteins, which repress a variety of genes via histone methylation, are concentrated in clusters that repress multiple chromatin domains. Cajal bodies are involved in snRNA modification and snRNP assembly, and nuclear speckles are storage sites of snRNPs and other components of the pre-mRNA splicing machinery.