**Chapter Review**

**Chapter 13: Mitochondria, Chloroplasts, and Peroxisomes**

13.1

Mitochondria are surrounded by a double-membrane system. The matrix contains the enzymes of the citric acid cycle; the inner membrane contains protein complexes involved in electron transport and oxidative phosphorylation. In contrast to the inner membrane, the outer membrane is freely permeable to small molecules. Mitochondria also contain their own genomes, which encode rRNAs, tRNAs, and some of the proteins involved in oxidative phosphorylation. However, most mitochondrial proteins are encoded by the nuclear genome. These proteins are translated on free ribosomes and imported into mitochondria as completed polypeptide chains. Positively charged presequences target proteins for import to the mitochondrial matrix and inner membrane, with protein import driven by the electrochemical gradient across the inner membrane. The electrochemical gradient also drives the transport of ATP, ADP, and other metabolites into and out of mitochondria.

13.2

Chloroplasts are large organelles that function in photosynthesis and other metabolic activities. Like mitochondria, chloroplasts are bounded by a double-membrane envelope. In addition, chloroplasts have an internal thylakoid membrane, which is the site of electron transport and ATP generation. Chloroplast genomes contain approximately 150 genes, including proteins involved in photosynthesis and metabolism. Most chloroplast proteins are synthesized on free ribosomes in the cytosol and targeted for import to chloroplasts by amino-terminal transit peptides. Most proteins incorporated into the thylakoid lumen are first imported into the chloroplast stroma and then targeted for transport across the thylakoid membrane. Other plastids store energy sources, such as starch and lipids, and function in diverse aspects of plant metabolism.

13.3

Peroxisomes are small organelles, bounded by a single membrane, that contain enzymes involved in a variety of metabolic reactions, including fatty acid oxidation, lipid biosynthesis, the glyoxylate cycle, and photorespiration. Most transmembrane proteins are transported to peroxisomes from the ER, whereas internal peroxisomal proteins are synthesized on free ribosomes in the cytosol and imported into peroxisomes as completed and folded polypeptide chains. Peroxins can be formed both *de novo* and by growth and division of existing peroxisomes.