**Chapter Review**

**Chapter 14: The Cytoskeleton and Cell Movement**

14.1

Actin filaments are formed by the polymerization of monomers into a helix with distinct plus and minus ends. A variety of actin-binding proteins regulate the assembly and disassembly of actin filaments within the cell, as well as the organization of filaments into bundles and networks. A network of actin filaments and associated proteins underlies the plasma membrane and determines cell shape. Actin bundles attached to the plasma membrane anchor the cell at regions of cell–cell and cell–substratum contact. Bundles of actin filaments also support protrusions of the cell surface, such as microvilli. Transient protrusions of the plasma membrane, driven by growth of actin filaments at the leading edge of the cell, are responsible for phagocytosis and cell locomotion.

14.2

Studies of muscle established the role of myosin as a motor protein that uses the energy derived from ATP hydrolysis to generate force and movement. Muscle contraction results from the sliding of actin and myosin filaments past each other. ATP hydrolysis drives repeated cycles of interaction between myosin and actin during which conformational changes result in movement of the myosin head group along actin filaments. Assemblies of actin and myosin II are responsible for a variety of movements of nonmuscle cells, including cytokinesis. Other types of myosin that do not function in contraction transport membrane vesicles and organelles along actin filaments.

14.3

Microtubules are formed by the reversible polymerization of tubulin. They display dynamic instability and undergo continual cycles of assembly and disassembly as a result of GTP hydrolysis following tubulin polymerization. The microtubules in most animal cells extend outward from a centrosome, located near the center of the cell. The centrosome usually contains a pair of centrioles surrounded by pericentriolar material. The growth of microtubules is initiated in the pericentriolar material, which then serves to anchor their minus ends. Selective stabilization of microtubules by posttranslational modification of tubulin and binding of microtubule associated proteins can determine their organization within the cell.

14.4

Two families of motor proteins, the kinesins and the dyneins, are responsible for movement along microtubules. Most kinesins move in the plus-end direction, whereas the dyneins and some members of the kinesin family move toward microtubule minus ends. Movement along microtubules transports macromolecules, membrane vesicles, and organelles through the cytoplasm, as well as positioning cytoplasmic organelles. Cilia and flagella are microtubule-based extensions of the plasma membrane, which act as sensors as well as being responsible for cell motility. Their movements result from the sliding of microtubules driven by the action of dynein motors. Microtubules reorganize at the beginning of mitosis to form the mitotic spindle, which is responsible for chromosome separation.

14.5

Intermediate filaments are polymers of more than 70 different proteins that are expressed in various types of cells. They are not involved in cell movement but provide mechanical support to cells and tissues. Intermediate filaments are formed from dimers of two polypeptide chains wound around each other in a coiled-coil structure. The dimers then associate to form tetramers, which assemble into protofilaments and filaments. Intermediate filaments form a network extending from a ring surrounding the nucleus to the plasma membrane of most cell types. In epithelial cells, intermediate filaments are anchored to the plasma membrane at regions of specialized cell contacts (desmosomes and hemidesmosomes). Intermediate filaments also play specialized roles in muscle and nerve cells.