

CHAPTER 17

CYTOSKELETON

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17-1 Identify the cytoskeletal structures depicted in the epithelial cells shown in Figure Q17-1.

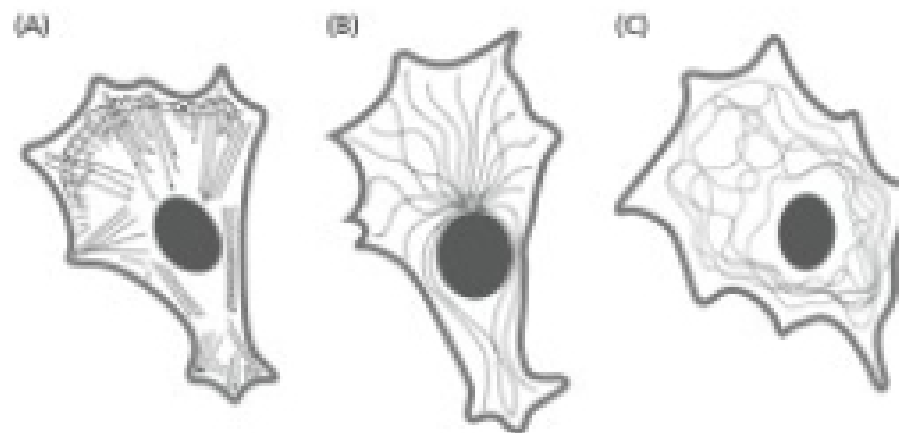


Figure Q17-1

- 17-2** Which of the following statements about the cytoskeleton is *false*?
- (a) The cytoskeleton is made up of three types of protein filament.
 - (b) The bacterial cytoskeleton is important for cell division and DNA segregation.
 - (c) Protein monomers that are held together with covalent bonds form cytoskeletal filaments.
 - (d) The cytoskeleton of a cell can change in response to the environment.
- 17-3** Indicate which of the three major classes of cytoskeletal elements each statement below refers to.
- A. monomer that binds ATP
 - B. includes keratin and neurofilaments
 - C. important for formation of the contractile ring during cytokinesis
 - D. supports and strengthens the nuclear envelope
 - E. their stability involves a GTP cap
 - F. used in the eucaryotic flagellum
 - G. a component of the mitotic spindle
 - H. can be connected through desmosomes
 - I. directly involved in muscle contraction
 - J. abundant in filopodia

- 17-4** Which of the following statements about the cytoskeleton is true?
- (a) All eucaryotic cells have actin, microtubules, and intermediate filaments in their cytoplasm.
 - (b) The cytoskeleton provides a rigid and unchangeable structure important for the shape of the cell.
 - (c) The three cytoskeletal filaments perform distinct tasks in the cell and act completely independently of one another.
 - (d) Actin filaments and microtubules have an inherent polarity, with a plus end that grows more quickly than the minus end.
- 17-5** Rank the following cytoskeletal filaments from smallest to largest in diameter (1 = smallest in diameter, 4 = largest)
- _____ intermediate filaments
 - _____ microtubules
 - _____ actin filament
 - _____ myofibril

Intermediate Filaments

- 17-6** Which of the statements below about intermediate filaments is *false*?
- (a) They can stay intact in cells treated with concentrated salt solutions.
 - (b) They can be found in the cytoplasm and the nucleus.
 - (c) They can be anchored to the plasma membrane at cell-cell junction.
 - (d) Each filament is about 10 μm in diameter.
- 17-7** Intermediate filaments are made from elongated fibrous proteins that are assembled into a ropelike structure. Figure Q17-7 shows the structure of an intermediate filament subunit. You are interested in how intermediate filaments are formed, and you create an intermediate filament subunit whose α -helical region is twice as long as that of a normal intermediate filament by duplicating the normal α -helical region while keeping a globular head at the N-terminus and a globular tail at the C-terminus; you call this subunit IF 2α d. If you were to assemble intermediate filaments using IF 2α d as the subunit, which of the following predictions below describes the most likely outcome?



Figure Q17-7

- (a) Filaments assembled using IF α d will interact with different cytoskeletal components.
- (b) Filaments assembled using IF α d will form dimers that are twice as long as dimers assembled from normal intermediate filaments.
- (c) Sixteen tetramers assembled from IF α d will be needed for a ropelike structure to form.
- (d) Dimers of IF α d will form by interactions with the N-terminal globular head and the C-terminal globular tail.

17-8 For each of the following sentences, fill in the blanks with the best word or phrase selected from the list below. Not all words or phrases will be used; use each word or phrase only once.

Intermediate filaments are found mainly in cells that are subject to mechanical stress. Mutations in genes that disrupt intermediate filaments cause some rare human diseases. For example, the skin of people with epidermolysis bullosa simplex is very susceptible to mechanical injury; people with this disorder have mutations in their _____ genes, the intermediate filament found in epithelial cells. These filaments are usually connected from cell to cell through junctions called _____s. The main filaments found in muscle cells belong to the _____ family; people with disruptions in these intermediate filaments can have muscular dystrophy. In the nervous system, _____s help strengthen the extremely long extensions often present in nerve cell axons; disruptions in these intermediate filaments can lead to neurodegeneration. People who carry mutations in the gene for _____, an important protein for cross-linking intermediate filaments, have a disease that combines symptoms of epidermolysis bullosa simplex, muscular dystrophy, and neurodegeneration.

desmosome

lamin

synapse

keratin

neurofilament

vimentin

kinase

plectin

17-9 Match the type of intermediate filament with its appropriate location.