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Cytoskeleton

Study Guide — Cell Organelles

Pre-Med practice questions about microtubules, microfilaments, and intermediate filaments

9 items — Study Guide with Answers

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Generated February 20, 2026

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1 **Which cytoskeletal element is correctly matched with one of its primary functions?**

A Microtubules - forming the contractile ring during cytokinesis.

B Microfilaments (actin) - providing tracks for intracellular transport of vesicles by kinesin and dynein.

C **Intermediate filaments - providing mechanical strength and resisting stretching of cells.** ✓

D Microtubules - forming the core of microvilli.

E Intermediate filaments - powering muscle contraction by sliding past myosin.

▶ **Explanation:** Intermediate filaments, such as keratins, form rope-like structures that provide tensile strength; actin forms the contractile ring and microvilli, while microtubules act as tracks for kinesin and dynein.

2 **The mitotic spindle that segregates chromosomes during mitosis is primarily composed of:**

A Actin microfilaments.

B Intermediate filaments.

C **Microtubules.** ✓

D Collagen fibers.

E Elastic fibers.

▶ **Explanation:** Mitotic spindles are built from microtubules that attach to kinetochores and separate chromosomes.

3 **Cilia and eukaryotic flagella share which structural feature?**

A A core of actin filaments arranged in a 13-protofilament pattern.

B **A 9+2 arrangement of microtubules.** ✓

C A single central microtubule surrounded by 10 peripheral microtubules.

D An entirely intermediate-filament-based core.

E Absence of any motor proteins.

▶ **Explanation:** Motile cilia and eukaryotic flagella have a 9+2 axoneme: nine doublet microtubules surrounding two central singlet microtubules, with dynein motor proteins.

4 **Which structure contains a core bundle of actin microfilaments rather than microtubules?**

A Mitotic spindle.

B Cilia of respiratory epithelium.

C Eukaryotic flagellum.

D **Intestinal microvillus.** ✓

E Centrosome.

▶ **Explanation:** Microvilli are supported by parallel bundles of actin filaments, whereas cilia and flagella have microtubule-based axonemes.

5 **Kinesin and dynein are motor proteins that primarily move along:**

A Intermediate filaments, using ATP.

B Actin filaments, using ATP.

C **Microtubules, using ATP.** ✓

D Collagen fibers, using GTP.

E The nuclear lamina, using ATP.

▶ **Explanation:** Kinesin and dynein move cargo along microtubules using ATP; myosin is the main actin-based motor.

6 **Depolymerization of microtubules by a drug such as colchicine would most directly interfere with:**

A **Formation of the mitotic spindle.** ✓

B Assembly of the contractile ring during cytokinesis.

C Maintenance of intestinal microvilli.

D Formation of the nuclear lamina.

E Primary structure of collagen.

▶ **Explanation:** Colchicine prevents microtubule polymerization; microtubules are essential for mitotic spindle formation, so chromosome segregation is blocked.

7 **During directed cell migration, a fibroblast extends a lamellipodium at its leading edge. Which cytoskeletal process is most directly responsible for pushing the plasma membrane forward in this region?**

A Depolymerization of actin filaments at the leading edge.

B **Polymerization of actin filaments at their plus ends near the plasma membrane.** ✓

C Dynein-mediated sliding of microtubules.

D Contraction of intermediate filaments.

E Depolymerization of microtubules at their minus ends.

▶ **Explanation:** Actin polymerization at the plus (barbed) ends against the membrane generates protrusive force that drives lamellipodium extension during cell motility.

8 **Which type of cell junction connects intermediate filaments of one epithelial cell to those of a neighbouring cell, thereby helping epithelial sheets resist mechanical stress?**

A Tight junction.

B Gap junction.

C **Desmosome.** ✓

D Hemidesmosome.

E Adherens junction.

▶ **Explanation:** Desmosomes anchor intermediate filaments of adjacent cells via cadherins, distributing mechanical stress across the tissue; hemidesmosomes link intermediate filaments to the extracellular matrix instead.

9 **In a polarized secretory cell, vesicles carrying cargo from the Golgi apparatus to the plasma membrane move predominantly toward the cell periphery along microtubules. Which statement best describes this movement?**

A **Kinesin motors move vesicles toward the plus ends of microtubules oriented toward the cell periphery.** ✓

B Dynein motors move vesicles toward the minus ends of microtubules located near the cell cortex.

C Kinesin motors move vesicles toward the minus ends of microtubules at the centrosome.

D Myosin II motors move vesicles along intermediate filaments without using ATP.

E Vesicle movement along microtubules is independent of ATP hydrolysis.

▶ **Explanation:** In most animal cells, microtubule plus ends extend toward the cell periphery; kinesins are typically plus-end-directed motors that carry secretory vesicles outward from the centrosome/Golgi region.