Test Bank for Biochemistry 5th Edition by Garrett and Grisham

Chapter 16—Molecular Motors

MULTIPLE CHOICE

1. All are characteristics of molecular motors or motor proteins EXCEPT:

a. They must be able to associate and dissociate reversibly with a polymeric protein array, a surface or substructure in the cell.
b. They use chemical energy (e.g., ATP) to orchestrate movement.
c. They transfer ATP energy into mechanical energy.
d. ATP hydrolysis is presumed to drive and control protein conformational changes that result in sliding or walking movement of one molecule relative to another.
e. All are true.

ANS: E PTS: 1

2. Microtubules are ____ structures formed from ____.

a. solid; myosin
b. self-assembling; phospholipids
c. hollow; membranes
d. self-assembling; tubulin
e. solid; tubulin

ANS: D PTS: 1

3. Self-assembly of microtubules occur by:

a. helical twisting of strands of a-tubulin and b-tubulin.
b. intermolecular interactions of dimers of a-tubulin and b-tubulin.
c. polymerization of alternating a- and b-tubulin into a repeating a-b-a-b-… strand.
d. inter-subunit interaction to form a_2b_2-tetramers of tubulin.
e. ATP-dependent polymerization of tubulin monomers.

ANS: B PTS: 1

4. All of the following are characteristics of microtubules EXCEPT:

a. they are made up of two repeating subunits.
b. they grow at one end and are degraded at the other end.
c. they are static, helical structures.
d. they are hollow, cylindrical structures.
e. they are polar structures.

ANS: C PTS: 1

5. Treadmilling as carried out by microtubules means:

a. ATP-hydrolysis-dependent movement over a plane.
b. ATP-dependent addition of dimmers to the plus end.
c. GTP-hydrolysis-dependent movement of a-tubulin over b-tubulin.
d. GTP-dependent addition to the plus end and removal at the minus end.
e. ATP-dependent “walking” along a surface in one place.

ANS: D PTS: 1

6. All are functions of microtubules EXCEPT:

a. providing variations and maintenance of cell shape.
b. formation of the mitotic spindle during cell division.
c. unwinding DNA to single-stranded DNA (ssDNA).
d. movement of organelles.
e. forming intracellular scaffolds.

ANS: C PTS: 1

7. All are true for ciliary motion EXCEPT:

a. complex bundles of microtubular fibers form axoneme.
b. axoneme are surrounded by plasma membrane that is continuous with the plasma membrane of the cell.
c. dynein molecules bridge between microtubules alternating their "walking" along both bridging microtubules.
d. ATP-driven sliding or walking of dyneins occurs along microtubules.
e. the result is a bending motion of axoneme and subsequent bending of the cilia.

ANS: C PTS: 1

8. Intracellular movement of organelles in axons occurs through:

a. axoneme motion through ATP-driven walking of dyneins along microtubules.

b. formation of ring-like structures around tubulin to move organelles.
c. progressive movement along DNA strands.
d. kinesin-mediated ATPase driven movement along microtubules.
e. all of the above.

ANS: D PTS: 1

9. Kinesins are proteins that exhibit ATPase activity and are involved with:

a. movement of flagella.
b. movement of cilia.
c. movement of muscles.
d. intracellular movement of organelles and vesicles from the minus end to plus end of microtubules.
e. A-tubule and B-tubule movement within an axoneme.

ANS: D PTS: 1

10. The proposed sequence for kinesin movement along a microtubule is:

A. Leading head binds a new site on tubulin with ADP dissociation.
B. The kinesin head with ATP is bound to tubulin, and the kinesin head with ADP is ready to move ahead.
C. Conformation change in the neck linkers flipping the trailing head to the next tubulin binding site.
D. ADP and Pi dissociation and ATP binds leading head.

a. D, C, B, A
b. B, C, A, D
c. B, D, A, C
d. A, C, B, D
e. C, A, D, B

ANS: B PTS: 1

11. All of the following affect microtubule polymerization and are used in cancer chemotherapy EXCEPT:

a. Taxol.
b. colchicine.
c. vinblastine.
d. vincristine.
e. all are used.

ANS: B PTS: 1

12. Rep helicase of *E. coli* and kinesin are alike in that they both have:

a. binding sites for the DNA lattice.
b. ring-like structures that encircle the substrate.
c. two subunits, one of which is always bound to the polymer at any moment.
d. tubulin binding heads that hydrolyze ATP.
e. the capacity to move organelles.

ANS: C PTS: 1

13. Negative cooperativity of Rep helicase from *E. coli* means that:

a. when one subunit binds DNA, the other releases from the DNA.

b. when both subunits are bound to DNA, ATP hydrolysis promotes release of both subunits.

c. ATP hydrolysis promotes DNA binding of both subunits simultaneously.

d. once it binds ssDNA, binding dsDNA is prohibited.

e. none of the above.

ANS: A PTS: 1

14. Myofibrils are linear arrays of cylindrical ____, the basic structural unit in the contraction of striated muscle.

a. foot structures

b. sarcomeres

c. sarcolemmas

d. sarcoplasmic reticulum (SR)

e. t-tubules

ANS: B PTS: 1

15. The component that houses a high concentration of Ca^{2+} and releases it to trigger muscle contraction is:

a. sarcoplasmic reticulum.

b. sarcomere.

c. t-tubules.
d. sarcolemma.
e. troponin.

ANS: A PTS: 1

16. All of the statements about the bands observed by electron microscopy of myofibrils are true EXCEPT:

a. I bands show a hexagonal array of thick filaments.
b. thin filaments are composed mainly of actin, troponin, and tropomyosin.
c. H zones contain an array of thick filaments that are composed mainly of myosin.
d. thick filaments are joined by cross-bridges.
e. Z lines lie in the middle of the I bands, marking the ends of the sarcomere.

ANS: A PTS: 1

17. The protein in the troponin complex that shows 70% homology to calmodulin and involved in Ca^{2+} binding is:

a. TnT.
b. TnC.
c. TnI.
d. TnA.
e. TnB.

ANS: B PTS: 1

18. Of the six polypeptides that make up the thick filament, the ATPase activity is in the:

a. LC1
b. LC2
c. Myosin heavy chains
d. Essential light chains
e. Regulatory light chains

ANS: C PTS: 1

19. In the b-sheet of the -a-b-a- segment of myosin, the ____ sequence likely binds ATP and is found in other nucleotide-binding proteins. The general sequence is:

a. cys-X-X-cys-X-his
b. arg-X-X-his-X-gly
c. gly-X-X-gly-X-gly
d. ser-X-arg-X-lys-X-gly
e. lys-X-gly-X-X-ser

ANS: C PTS: 1

20. If the non-hydrolyzable ATP analog b,g-methylene-ATP were given to muscle cells, where would inhibition occur?

a. during formation of the cross bridge between actin and myosin when Pi is released
b. during the conformational change in the myosin head that moves actin and myosin relative to each other
c. during the ATP binding step where actin and myosin dissociate
d. during the conformational change in the myosin head when ATP hydrolysis occurs

e. at steps c and d above

ANS: D PTS: 1

21. All of the following occur during muscle contraction EXCEPT:

a. the length of the sarcomere is reduced.
b. the length of the thick filament is reduced.
c. the contraction produces an increased overlap of the actin and myosin filaments of the A band.
d. ATP hydrolysis occurs.
e. the length of the thin filaments is constant.

ANS: B PTS: 1

22. Which of the following muscle protein components is responsible for ATP hydrolysis?

a. tropomyosin
b. myosin
c. troponin C
d. actin
e. troponin M

ANS: B PTS: 1

23. Order the reaction sequence for the involvement of free actin, free myosin and ATPase activity on each other.

A. Actin binds and activates ATPase activity by stimulating release of Pi and ADP.
In the absence of actin, the addition of ATP to myosin produces a rapid release of
B. H^+.
C. The binding of new ATP to the actomyosin complex.
D. Actomyosin dissociates into actin and myosin.
E. Low energy conformation change in myosin head.

a. B, A, E, C, D
b. A, B, C, D, E
c. B, E, C, A, D
d. E, B, A, D, C
e. C, A, D, E, B

ANS: A PTS: 1

24. The power stroke in muscle contraction is associated with:

a. the binding of ATP to ATPase.
b. the dissociation of ADP and Pi from the ATPase.
c. binding of myosin to actin.
d. addition of water for ATP hydrolysis.
e. the hydrolysis of ATP.

ANS: B PTS: 1

25. Muscle contraction is stimulated by:

a. an increase in [Ca^{2+}] in the vicinity of the muscle fibers.
b. a decrease in the [Ca^{2+}] in the mitochondria.
c. an increase in [Ca^{2+}] in the sarcolemma.
d. a decrease in the [Ca^{2+}] in the Golgi.
e. an increase in [Ca^{2+}] in the sarcoplasmic reticulum.

ANS: A PTS: 1

26. Which of the following troponin subunits is responsible for inhibiting actin-myosin binding?

a. troponin G
b. troponin I
c. troponin C
d. troponin M
e. troponin Y

ANS: B PTS: 1

27. Troponin C (TnC) exhibits all of the following characteristics EXCEPT:

a. TnC has two binding sites that are always complexed to Ca^{2+}.
b. the Ca^{2+} binding increases the interaction of TnC and TnI.
c. TnC has four equivalent Ca^{2+} binding sites.
d. Ca^{2+} binding to TnC decreases interaction between TnI and actin.
e. a conformational change in TnC occurs on Ca^{2+} binding.

ANS: C PTS: 1

28. In *E. coli*, rotation of the flagella is powered by:

a. phosphorylation of the motB protein by phosphoenolpyruvate.
b. a proton gradient across the plasma membrane of the bacterium.
c. the hydrolysis of ATP by the motB protein.
d. the hydrolysis of GTP by the flagella.
e. none of the above.

ANS: B PTS: 1

29. Which of the following loops are present in the myosin head to give rise to the ATP-binding site?

a. switch 1
b. switch 2
c. relay helix
d. converter domain
e. both A and B are correct

ANS: E PTS: 1

30. Which of the following best describes the conditions of switch 1, switch 2 and the actin-cleft during myosin rigor?

a. switch 1 open, switch 2 open, actin-cleft open
b. switch 1 open, switch 2 open, actin-cleft closed
c. switch 1 closed, switch 2 open, actin-cleft open
d. switch 1 open, switch 2 closed, actin-cleft closed
e. switch 1 open, switch 2 closed, actin-cleft open

ANS: D PTS: 1

31. Which of the following is the first event following ATP binding in the movement of actin and myosin?

a. binding of actin and myosin
b. the power stroke
c. dissociation of actin and myosin
d. the up-lever state
e. the down-lever state

ANS: C PTS: 1