Final Exam Sample Questions, Biol 2021, 2013

Each question has only one best answer. There are 35 questions and all questions are worth equal weight. Four figures are at the end.

These questions are from the last third of the course. The final exam will also include another 35 questions covering the entire course.

1. In a video shown in lecture, organelles are seen to move along cytoskeletal tracks in an in vitro preparation. One organelle can be seen to switch its direction of movement. What might cause such a reversal of the direction of movement?
a. The organelle could have two kinds of receptors for two different motor proteins that move in opposite directions.
b. The single kind of motor protein attached to the organelle could have a motor domain that is capable of moving in either direction.
c. The motor protein carrying the organelle could jump from one kind of cytoskeletal fiber (such as tubulin) to another (such as actin).
d. The single kind of motor protein attached to the organelle could have two different tail domains that can attach to microtubules in opposite orientations.
e. Any of the above could cause the reversal of direction.

2. In Figure A, what is the major protein found in the thick dark lines that the black arrow is pointing to?
a. chlorophyll
b. tropomyosin
c. tubulin
d. myosin
e. keratin
f. actin

3. During the sequence of events that occurs at the neuromuscular junction when a signal from the nerve causes a muscle to contract, voltage-gated calcium channels in the T-tubule membranes open. What is the next step in the sequence of events that is caused by the opening of the voltage-gated calcium channels?
a. An action potential is transmitted to the plasma membrane.
b. Myosin heads bind to the actin filaments.
c. Calcium is released from the sarcoplasmic reticulum into the cytosol.
d. Calcium binds to troponin.
e. The myosin and actin filaments slide against each other.

4. The eukaryotic cell cycle can be divided into stages but not all cells will follow exactly the same sequence of stages at all times. Which of the following cell cycles would be unlikely to happen in any eukaryotic cell?
a. $G_1 > S > G_2 > M > G_1 > S >$ etc.
b. S > M > S > M > etc.
c. $G_1 > S > G_2 > M > G_1 > S > G_0$
d. $G_1 > S > G_2 > M > G_1 > G_0$
e. b and c only
f. b and d only

5. In what stage of mitosis is the cell in Figure B?
a. anaphase
b. cytokinesis
c. metaphase
d. prometaphase
e. telophase
f. prophase

6. Which of the following statements about cyclin dependent kinases (cdks) is TRUE?
a. Cdks are inhibited by small proteins called cyclins.
b. Each cyclin-cdk complex phosphorylates a different set of substrates.
c. The activity of most cdks is primarily controlled by ubiquitin-mediated proteolysis of the cdk.
d. CKI proteins activate particular cdks.
e. G_1/S cdks are not found in all cells and are highly active in early G_1.
f. None of the above; they are all FALSE.

7. You have isolated a mutant of yeast that is defective in cdc25 phosphatase activity at high temperature but not at low temperature. What would probably happen at high temperature if the yeast is first grown at low temperature and then moved to high temperature?
a. The cells would continue dividing at the same rate at high temperature but would be smaller than normal.
b. The cells would die by apoptosis at high temperature.
c. The cells would stop dividing at high temperature or would divide very slowly and would be larger than normal.
d. The cells would divide at a faster rate at high temperature but would be normal in size.
e. There would be no difference between low and high temperature in the absence of drugs or treatments that damage the spindle.

8. Which of the following events is activated by M-cdk?
a. assembly of the mitotic spindle
b. breakdown of the nuclear envelope
c. chromosome condensation by condensin protein
d. formation of more microtubules and increased dynamic activity of microtubules
e. all of the above
f. a and d only

9. Where would you find interpolar microtubules?
a. radiating from the spindle poles and overlapping at the spindle equator (in the middle of the spindle)
b. radiating from the spindle poles outwards towards the cell cortex
c. starting from one spindle pole and ending at the other spindle pole
d. radiating from the spindle poles and attaching to sister chromatids in the middle of the spindle (at the equator)

10. How does the activation of APC trigger anaphase during mitosis?
a. APC directly cleaves cohesin proteins.
b. APC causes the destruction of cdc20.
c. APC causes the destruction of S-cyclin.
d. APC causes the destruction of separase.
e. APC phosphorylates M-cdk.
f. none of the above

11. Once M-cdk is inactivated at the end of mitosis, what is the most important process that controls events in telophase?
a. activation of telophase-specific protein kinases
b. APC-directed destruction of inhibitory proteins
c. activation of transcription of telophase-specific genes
d. dephosphorylation of proteins phosphorylated by M-cdk

12. Which of the following statements about cytokinesis in animal cells is FALSE?
a. Actin and myosin are important in forming the contractile ring that divides the cell.
b. During cytokinesis the Golgi elongates and divides like bacteria, and half is distributed to each of the daughter cells.
c. Not all mammalian cells must undergo cytokinesis after every mitosis.
d. The cleavage plane is determined by the position of the spindle such that cleavage happens about halfway between the poles.
e. a and c are both false

13. In cells that have a G_1 phase of the cell cycle, what helps maintain cdk activity at a low level?
a. APC is active and ensures the destruction of cyclins.
b. M-cdk inhibits cdh1.
c. Cyclin gene expression decreases in late M/G_1.
d. Production of CKIs is decreased.
e. a and c only
f. a, b and c only

14. What would probably happen to a cell in which the checkpoint kinases Chk1/Chk2 were inactivated if the cell was then exposed to DNA-damaging X rays?
a. The cell would immediately undergo apoptosis.
b. The cell would be likely to arrest the cell cycle permanently.
c. p53 would become permanently activated.
d. There would be no activation of ATM/ATR kinases.
e. b and c only
f. none of the above

15. Which of the following is NOT a component of an important pathway through which growth factors stimulate growth in animal cells?
a. PI 3-kinase
b. activation of a ribosomal protein
c. MAP kinase
d. activation of protein kinase TOR
e. activation of a translation initiation factor

16. Which of the following does NOT usually happen during apoptosis?
a. The nuclear envelope disassembles.
b. DNA is cleaved into small fragments.
c. Phosphatidylserine becomes exposed on the cell surface.
d. The cell swells and bursts.
e. The cytoskeleton collapses.
f. None of the above; they ALL usually happen during apoptosis.

17. Which of the following would be a target for cleavage by an initiator caspase?
a. an executioner pro-caspase
b. nuclear lamins
c. an inhibitor of DNA nuclease
d. Apaf1
e. b and c only
f. none of the above

18. What would be required to activate the extrinsic pathway of apoptosis?
a. a Fas ligand on the target cell and a Fas receptor in the killer cell membrane
b. a Fas ligand on the killer cell and a Fas receptor in the target cell membrane
c. an FADD adaptor protein in the membrane of the killer cell and a Fas receptor on the target cell
d. identical Fas receptors in both killer cell and target cell membranes
e. identical Fas ligands with intracellular death domains in both the target cell and the killer cell

19. How does a "BH3-only" protein promote apoptosis?
a. by inhibiting an anti-apoptotic BH123 protein
b. by aggregating to form a channel in the mitochondrial membrane
c. by inhibiting an anti-apoptotic Bcl2 protein
d. by binding cytochrome C and oligomerizing to form the apoptosome

20. In animals, how is mechanical stress distributed in connective tissue?
a. by the tight packing of many cells
b. by the cell-cell connections between cytoskeletal filaments
c. by the junctions between epithelial cells and the basal lamina
d. by the fibrous proteins and polysaccharides making up the extracellular matrix

21. If a cancer cell arises in an epithelium, which of the following would be most important for the cancer cell to be able to migrate away and form secondary tumours at other sites in the body?
a. the ability to secrete extracellular matrix components
b. the ability to divide without limits
c. the ability to avoid apoptosis
d. the ability to secrete proteases to degrade the basal lamina
e. the ability to express cell-cell adhesion proteins to form junctions with similar cells
f. b and c only

22. Claudin proteins are arranged in sealing strands to form what structures?
a. occluding junctions at the synapses between neurons
b. gap junctions between animal cells
c. anchoring junctions between cells and extracellular matrix
d. attachment points for intermediate filaments in cell-cell anchoring junctions
e. tight junctions between epithelial cells

23. In Figure C, the arrow is pointing at a cell. What type of cell is it most likely to be?
a. fibroblast
b. adult stem cell
c. muscle cell
d. epithelial cell
e. neuron

24. In epithelial cells, cadherins and keratin provide mechanical strength. What cell-cell junctions are involved?
a. adherens junctions
b. desmosomes
c. gap junctions
d. hemidesmosomes
e. focal adhesions

25. Which of the following statements is TRUE about inside-out activation of integrin?
a. When integrin binds to the matrix, a signal is generated that is sent to the inside of the cell.
b. Strong binding of talin to integrin causes strong binding of integrin to the extracellular matrix.
c. A signal generated inside the cell changes the conformation of the integrin proteins.
d. Strong binding of integrin to extracellular matrix causes a change in the behavior of the cell.
e. b and c only
f. a and d only

26. Which of the following is good evidence that all the cancer cells in a tumour are descendants of one single cell?
a. The same mutations are always found in different tumours of the same type in different patients.
b. All the cancer cells in a tumour have similar properties of unlimited proliferation.
c. The same mutations are found in all the individual cells of a particular tumour.
d. All the cells in a tumour progress towards malignancy at the same rate.

27. What do we conclude from the evidence that cancer incidence increases with age?
a. Exposure to carcinogens increases with age.
b. Cancer develops only when a cell accumulates many mutations.
c. A single mutation can cause cancer and the probability of mutation increases with age.
d. The risk of developing cancer is the same at every age but the probability of diagnosing it increases with age.

28. Which of the following would give a cell a competitive advantage in evolving into a cancer cell?
a. a mutation in a DNA repair pathway
b. an increased rate of apoptosis
c. a mutation that inactivates a DNA damage checkpoint
d. a mutation that increases signalling to cells that form blood vessels
e. all of the above
f. a, c and d only

29. Which of the following statements about the role of p53 in cancer is TRUE?
a. It is the most important tumour suppressor and mutations in p53 are found in almost all human cancers.
b. Inactivating the p53 gene contributes to the development of cancer.
c. p53 normally causes arrest of the cell cycle if DNA damage is detected.
d. If p53 fails to function properly, cells can accumulate DNA damage, leading to more mutations.
e. a and b only
f. all of the above

30. Which of the following is a reason why cancer cures can be successful?
a. Surgery is usually very effective in removing all cancer cells, including metastases.
b. Cancer cells undergo apoptosis readily and can often be induced to kill themselves.
c. Cancer cells are genetically very stable and will rarely evolve resistance to treatments.
d. Cancer drugs damage DNA and because cancer cells don't arrest their cell cycle in response to DNA damage they can die from too much DNA damage.
e. Anticancer drugs are very specific and only affect cancer cells, not normal cells.

31. Figure D is a TEM of a thin section of bone marrow. Most of the cells you can see are probably:
a. induced pluripotent stem cells
b. hemopoeitic adult stem cells
c. embryonic stem cells
d. transit amplifying cells
e. terminally differentiated cells

32. According to the cancer stem cell theory, what kind of cells make up the bulk of a typical tumour?
a. slowly-dividing cancer differentiated cells
b. rapidly-dividing cancer transit amplifying cells
c. rapidly-dividing cancer stem cells
d. slowly-dividing cancer stem cells
e. slowly-dividing cancer transit amplifying cells

33. Which of the following is an example of how stem cells are currently being used successfully and routinely in medical treatments?
a. treatment of leukemia with bone marrow transplants
b. transplantation of neurons for treatment of Parkinson's
c. replacement of pancreatic beta cells for treatment of diabetes
d. repair of heart muscle damaged in heart attacks
e. a and c only
f. None of the above; all stem cell therapy is still in the experimental stage.

34. What cells would you harvest if you wanted to prepare embryonic stem cells?
a. bone marrow
b. the placenta from an embryo
c. the inner cell mass of a blastocyst
d. fibroblasts
e. epidermal cells from embryonic skin

35. Which of the following would be an advantage in using induced pluripotent stem cells (iPS cells) as compared to embryonic stem cells if you are trying to develop a treatment for a condition such as spinal cord injury?
a. iPS cells are quick and easy to prepare in the laboratory.
b. iPS cells can be made from the patient's own cells so they are genetically identical.
c. iPS cells have been show to be identical to embryonic stem cells in every test so far.
d. Preparation of iPS cells does not always require the destruction of embryos.
e. all of the above
f. b and d only

Fig. A

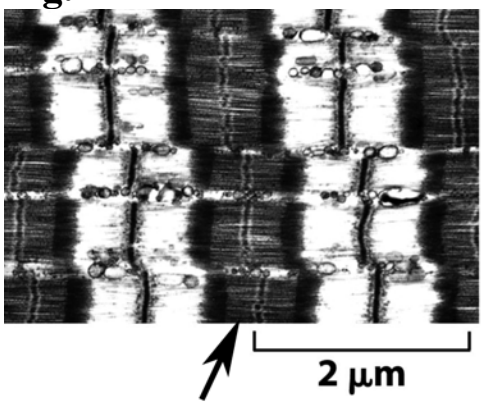

Fig. B

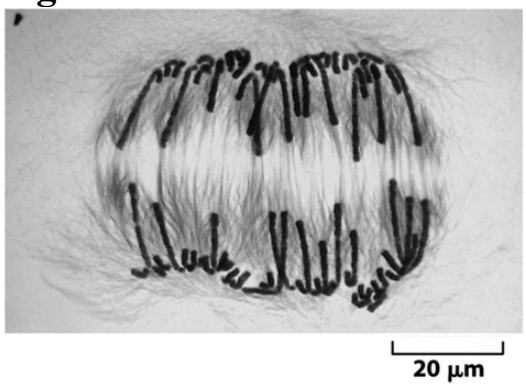

Fig. C

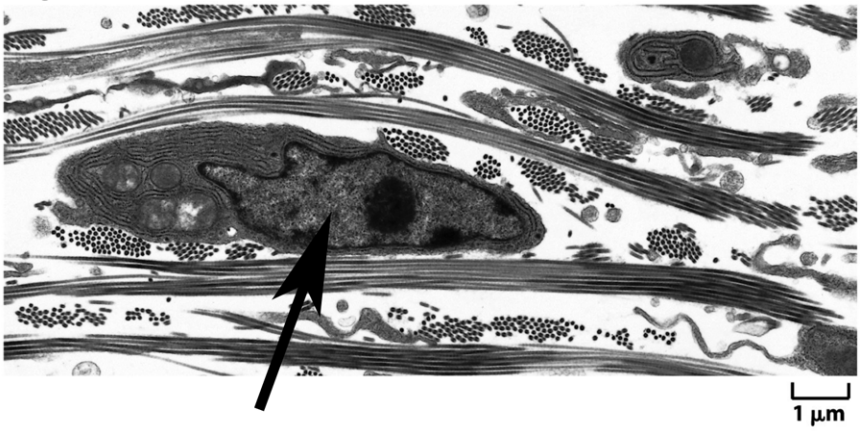

Fig. D