# Chapter 02
# Cells

## Multiple Choice Questions

1. The cellular basis of muscular dystrophy is that some of a child's muscle cells
A. have combined into a structure that cannot contract.
B. lack DNA.
**C.** lack a protein that enables them to withstand the force of contraction.
D. have too much of a contractile protein and become overworked.
E. have become haploid.

*Difficulty: Remember/Understand*
*Section: 02.01*
*Topic: Genetics*

2. A researcher identifies an abnormality in a protein that causes a particular inherited illness. To develop a treatment, it would be most helpful to know
A. the chromosome on which the gene that encodes the protein is found.
**B.** which cells are affected and how to replace the protein's function in them.
C. the sequence of the gene that encodes the protein.
D. the other types of molecules that cause or contribute to the disease.
E. the type of mutation that affects the protein.

*Difficulty: Evaluate/Create*
*Section: 02.01*
*Topic: Genetics*

3. Which of the following statements is true?
**A.** Somatic cells are diploid, meaning that they have two copies of the human genome.
B. Somatic cells are haploid, meaning that they have one copy of the human genome.
C. Sperm and egg cells are diploid, meaning that they have two copies of the human genome.
D. Stem cells are haploid, meaning that they have one copy of the human genome.
E. Nerve and muscle cells are haploid, but other differentiated cells are diploid.

*Difficulty: Evaluate/Create*
*Section: 02.01*
*Topic: Genetics*

4. The approximate number of differentiated cell types in a human body is
A. 10.
B. 100.
**C.** 260.
D. 840.
E. 3.2 billion.

*Difficulty: Remember/Understand*
*Section: 02.01*
*Topic: Cells*

5. Humans belong to domain _____, which is distinguished by cells that have _____.
A. Prokarya; organelles
B. Archaea; ancient organelles
**C.** Eukarya; organelles
D. Prokarya; proteins
E. Humana; organelles

*Difficulty: Evaluate/Create*
*Section: 02.02*
*Topic: Cells*

6. Ribosomes are in the cells of
A. bacteria only.
B. eukaryotes only.
C. animals only.
D. vertebrates only.
**E.** all organisms.

*Difficulty: Apply/Analyze*
*Section: 02.02*
*Topic: Cells*

7. The major macromolecules that make up cells are
A. ribosomes, Golgi apparatus, endoplasmic reticulum, and lysosomes.
B. vitamins and minerals.
C. carbon, hydrogen, nitrogen, oxygen, and phosphorus.
**D.** carbohydrates, proteins, lipids, and nucleic acids.
E. eukaryotes, prokaryotes, and archaea.

*Difficulty: Evaluate/Create*
*Section: 02.02*
*Topic: Cells*

8. About ___ average-sized bacteria could fit into a human cell.
A. 10
B. 100
**C.** 1,000
D. 10,000
E. one million

*Difficulty: Apply/Analyze*
*Section: 02.02*
*Topic: Cells*

9. Organelles protect a cell by
**A.** sequestering biochemicals that could dismantle other cellular structures.
B. forming a thick outer barrier.
C. containing powerful enzymes that kill any bacteria that enter.
D. placing flag-like molecules on a cell's surface identifying that cell as belonging to a particular person.
E. producing new DNA if the genetic material is damaged.

*Difficulty: Evaluate/Create*
*Section: 02.02*
*Topic: Cells*

10. The nuclear lamina is
A. the sac that holds the genetic material.
B. part of the nucleus that holds RNA.
**C.** a fibrous layer that lines the inner face of the nuclear membrane.
D. the site of protein synthesis.
E. a single loop of the endoplasmic reticulum.

*Difficulty: Evaluate/Create*
*Section: 02.02*
*Topic: Cells*

11. In a human cell, the genetic material is in the
A. endoplasmic reticulum.
B. lysosome.
C. ribosome.
**D.** nucleus.
E. cytoplasm.

*Difficulty: Remember/Understand*
*Section: 02.02*
*Topic: Cells*

12. The organelles that contain DNA are the
A. Golgi apparatus and lysosome.
B. mitochondrion and plasma membrane.
**C.** nucleus and mitochondrion.
D. nuclear lamina and endoplasmic reticulum.
E. lysosome and peroxisome.

*Difficulty: Remember/Understand*
*Section: 02.02*
*Topic: Cells*

13. What is the sequence of events to produce a protein that is secreted?
**A.** A hormone signals the gene that encodes the protein to be transcribed into mRNA in the nucleus. The mRNA is translated into protein on the ER, then processed and folded in the Golgi apparatus, and then sent out of the cell in a vesicle.
B. A hormone signals a protein-filled vesicle to move from the plasma membrane into the cell and into the nucleus, where it stimulates transcription of the appropriate gene into mRNA. The mRNA exits the nucleus and is translated into protein on the ER and processed and folded in the Golgi apparatus. Finally, the protein is transported out of the cell in a vesicle.
C. A hormone binds to the plasma membrane, signaling proteins near the membrane to fall apart into amino acids. These enter the nucleus and stimulate replication of the gene encoding the protein.
D. The protein is produced as a linear molecule in the nucleus, then exits through nuclear pores. On the ER the protein folds into its active form and at the Golgi apparatus is packed into a vesicle, which carries it across the plasma membrane and out of the cell.
E. A hormone signals the gene that encodes the protein to be transcribed into mRNA in the nucleus, and translated into protein on the ER and processed and folded in the Golgi apparatus. The protein travels freely through the plasma membrane to exit the cell.

*Difficulty: Evaluate/Create*
*Section: 02.02*
*Topic: Cells*

14. The organelle that consists of a stack of flat, membrane-enclosed sacs is the
A. mitochondrion.
B. nucleolus.
C. ER.
**D.** Golgi apparatus.
E. nucleus.

*Difficulty: Remember/Understand*
*Section: 02.02*
*Topic: Cells*

15. The organelle that is the equivalent of a cellular garbage disposal system is the
A. nucleus.
**B.** lysosome.
C. mitochondrion.
D. glucosome.
E. Golgi apparatus.

*Difficulty: Remember/Understand*
*Section: 02.02*
*Topic: Cells*

16. A bubble-like structure that ferries molecules, such as cholesterol, to lysosomes is an
**A.** endosome.
B. episome.
C. oprahsome.
D. ectosome.
E. liposome.

*Difficulty: Remember/Understand*
*Section: 02.02*
*Topic: Cells*

17. In mitochondria,
**A.** energy from nutrients is converted into a form that a cell can use.
B. all of a cell's DNA is replicated.
C. fats and carbohydrates are degraded.
D. sugars are added to proteins.
E. proteins are folded.

*Difficulty: Remember/Understand*
*Section: 02.02*
*Topic: Cells*

18. The cell type with the most mitochondria is
**A.** muscle.
B. nerve.
C. fat.
D. sperm.
E. red blood cell.

*Difficulty: Remember/Understand*
*Section: 02.02*
*Topic: Cells*

19. Cristae are
A. types of genes.
B. types of insects.
**C.** membranous structures that are parts of mitochondria.
D. bits of sugars in the Golgi apparatus.
E. types of plasma membrane proteins.

*Difficulty: Remember/Understand*
*Section: 02.02*
*Topic: Cells*

20. In a DNA molecule, the sugar-phosphate backbone is the same in everyone, but the base sequence is different in everyone. A plasma membrane is similar conceptually to DNA in that
**A.** the lipid bilayer is the same in everyone, but the nature and pattern of the molecules embedded in it differ.
B. the pattern of embedded proteins in the plasma membrane is the same in everyone, but the lipid bilayer differs.
C. the lipid bilayer and pattern of embedded proteins differ in everyone.
D. the lipid bilayer is the same in everyone, but some people have the embedded proteins sticking out of the outer face of the membrane, and others have the proteins extending inward.
E. it encodes information in a sequence of molecules.

*Difficulty: Evaluate/Create*
*Section: 02.02*
*Topic: Genetics*

21. A molecule that binds a cell surface receptor is called a
A. lizard.
B. nucleic acid.
**C.** ligand.
D. nuclear pore.
E. mitochondrion.

*Difficulty: Evaluate/Create*
*Section: 02.02*
*Topic: Cells*

22. The internal scaffolding of a cell consists of
**A.** microtubules and microfilaments.
B. cilia and flagella.
C. chitin and chlorophyll.
D. lipid bilayers.
E. glycoproteins and glycolipids.

*Difficulty: Remember/Understand*
*Section: 02.02*
*Topic: Cells*

23. Cilia are built of
A. microorganisms.
B. microfilaments.
C. micronutrients.
**D.** microtubules.
E. intermediate filaments.

*Difficulty: Remember/Understand*
*Section: 02.02*
*Topic: Cells*

24. The cytoskeletal component that consists of different protein types in different cell is
A. a microtubule.
**B.** an intermediate filament.
C. a microfilament.
D. a fibrous filament.
E. a plasma membrane.

*Difficulty: Remember/Understand*
*Section: 02.02*
*Topic: Cells*

25. In hereditary spherocytosis, red blood cells lose their doughnut shapes, ballooning out, because they have abnormal
A. microtubules, which consist of tubulin molecules.
B. microfilaments, which consist of actin molecules.
**C.** ankyrin molecules, which bind spectrin rods to the plasma membrane.
D. CFTR proteins, which entrap salt inside cells.
E. hemoglobin, which leaks out of the cells.

*Difficulty: Evaluate/Create*
*Section: 02.02*
*Topic: Cells*

26. The approximate percentage of our cells that are replaced daily is
A. 0.01%.
B. 0.1%.
C. 1%.
**D.** 10%.
E. 23%.

*Difficulty: Remember/Understand*
*Section: 02.03*
*Topic: Cells*

27. The two major stages of the cell cycle are
A. interphase and prophase.
**B.** interphase and mitosis.
C. mitosis and meiosis.
D. mitosis and apoptosis.
E. anaphase and telophase.

*Difficulty: Evaluate/Create*
*Section: 02.03*
*Topic: Cells*

28. The cell cycle is a series of events a cell undergoes as it prepares to
A. secrete.
**B.** divide.
C. die.
D. adhere to another cell.
E. pass along a signal.

*Difficulty: Remember/Understand*
*Section: 02.03*
*Topic: Cells*

29. DNA replicates during __ phase of the cell cycle.
A. $G_1$
B. $G_2$
C. $G_3$
**D.** S
E. prophase of mitosis

*Difficulty: Remember/Understand*
*Section: 02.03*
*Topic: Cells*

30. The order of events in the cell cycle is
A. S to $G_1$ to $G_2$ to mitosis.
B. Mitosis to $G_1$ to $G_2$ to S.
C. $G_1$ to $G_2$ to S to mitosis.
**D.** $G_1$ to S to $G_2$ to mitosis.
E. $G_0$ to mitosis to $G_0$.

*Difficulty: Evaluate/Create*
*Section: 02.03*
*Topic: Cells*

31. At the point in the cell cycle when mitosis begins
A. the chromatids have separated into two identical chromosomes.
B. DNA replication begins.
**C.** each chromosome consists of two identical chromatids joined at the centromere.
D. chromosome number is halved.
E. the cell enters a dormant phase.

*Difficulty: Remember/Understand*
*Section: 02.03*
*Topic: Cells*

32. Chromosomes coil tightly around chromosomal proteins and condense during
**A.** prophase.
B. metaphase.
C. anaphase.
D. telophase.
E. interphase.

*Difficulty: Remember/Understand*
*Section: 02.03*
*Topic: Genetics*

33. Cells contain twice the normal number of chromosomes briefly during
A. prophase.
B. metaphase.
**C.** anaphase.
D. telophase.
E. genophase.

*Difficulty: Remember/Understand*
*Section: 02.03*
*Topic: Genetics*

34. During S phase, replicated chromosomes are joined at their
A. centrosomes.
**B.** centromeres.
C. middlemeres.
D. telomeres.
E. spindles.

*Difficulty: Remember/Understand*
*Section: 02.03*
*Topic: Genetics*

35. The part of a chromosome that shortens with each cell division, functioning as a "clock," is the
A. centromere.
B. centrosome.
C. centriole.
**D.** telomere.
E. teleost.

*Difficulty: Remember/Understand*
*Section: 02.03*
*Topic: Genetics*

36. Factors that control how often a cell divides include
A. telomere lengths, hormonal signals, crowding, and growth factors.
B. which chromosomes are active and which are not.
C. the activity level of the person, diet, and environmental exposures.
D. where chromosomes are located within the nucleus.
**E.** whether the nuclear membrane has broken apart or is intact.

*Difficulty: Remember/Understand*
*Section: 02.03*
*Topic: Cells*

37. During apoptosis, caspases
A. stimulate synthesis of carcinogens.
**B.** activate enzymes that cut DNA into same-sized pieces.
C. cause mitochondria to replicate their DNA.
D. alter the cell surface so that viruses can more easily enter.
E. remove introns from DNA.

*Difficulty: Evaluate/Create*
*Section: 02.03*
*Topic: Cells*

38. Apoptosis is a form of
**A.** programmed cell death that is a normal part of development.
B. programmed cell division that is a normal part of development.
C. programmed cell death that is a normal part of differentiation.
D. reprogrammed cell division that is a normal part of inflammation.
E. cellular adhesion.

*Difficulty: Evaluate/Create*
*Section: 02.03*
*Topic: Cells*

39. Which sequence of events illustrates the steps of signal transduction?
**A.** First messenger to receptor molecules to second messenger to cellular response
B. Receptor molecules to first messenger to second messenger to cellular response
C. First messenger to second messenger to receptor molecules to cellular response
D. First messenger to second messenger to cellular responses to receptor
E. Prophase, metaphase, anaphase, telophase

*Difficulty: Evaluate/Create*
*Section: 02.04*
*Topic: Cells*

40. Proteins that are part of signal transduction pathways in the cell are located in
A. the endoplasmic reticulum and Golgi apparatus.
B. microtubules and microfilaments.
**C.** cytoplasm and plasma membrane.
D. nucleus and nucleolus.
E. mitochondria and lysosomes.

*Difficulty: Remember/Understand*
*Section: 02.04*
*Topic: Cells*

41. Cellular adhesion molecules include
A. DNA and RNA.
**B.** selectins and integrins.
C. first and second messengers.
D. hormones and growth factors.
E. insulin and glucagon.

*Difficulty: Remember/Understand*
*Section: 02.04*
*Topic: Cells*

42. In which disease is signal transduction abnormal?
A. diabetes mellitus
B. restless legs syndrome
C. acne
**D.** neurofibromatosis type 1
E. appendicitis

*Difficulty: Apply/Analyze*
*Section: 02.04*
*Topic: Cells*

43. In which disease is cellular adhesion abnormal?
A. heart disease
B. Parkinson disease
C. pattern baldness
**D.** arthritis
E. irritable bowel syndrome

*Difficulty: Apply/Analyze*
*Section: 02.04*
*Topic: Cells*

44. The defining characteristic of a stem cell is
A. self-repair.
**B.** self-renewal.
C. the ability to turn into a cancer cell.
D. origin from a progenitor cell.
E. ability to be part of an embryo.

*Difficulty: Remember/Understand*
*Section: 02.05*
*Topic: Cells*

45. A difference between a stem cell and a progenitor cell is that
**A.** a progenitor cell cannot self-renew and a stem cell can.
B. a stem cell cannot self-renew and a progenitor cell can.
C. a progenitor cell only yields daughter cells less specialized than itself, whereas a stem cell can yield daughter cells more specialized than itself.
D. progenitor cells are rare but stem cells are abundant.
E. progenitor cells are not present in embryos but stem cells are.

*Difficulty: Evaluate/Create*
*Section: 02.05*
*Topic: Cells*

46. A cell that can divide to give rise to any cell type, including those of membranes that support the developing embryo, is
A. pluripotent.
B. multipotent.
C. a progenitor cell.
D. a differentiated cell.
**E.** totipotent.

*Difficulty: Remember/Understand*
*Section: 02.05*
*Topic: Cells*

47. An experimental treatment for amyotrophic lateral sclerosis (Lou Gehrig's disease), which causes gradual loss of the ability to move, sends four genes into cells sampled from a patient's skin. This procedure reprograms the cells, which are then exposed to molecules and genes that stimulate them to develop as healthy versions of the cells affected in the disease. These cells are implanted into the patient. They are
A. embryonic stem cells.
B. adult connective tissue stem cells.
**C.** induced pluripotent stem cells.
D. apoptotic cells.
E. cloned cells.

*Difficulty: Apply/Analyze*
*Section: 02.05*
*Topic: Cells*

48. Human embryonic stem cells that are used in research are
A. cultured in the bodies of human embryos from outer cell mass cells.
**B.** cultured in laboratory dishes from inner cell mass cells taken from a 5-day embryo.
C. taken from aborted human fetuses between 10 and 12 weeks of gestation.
D. taken from stillbirths that do not have genetic diseases.
E. donated from the umbilical cords of newborns.

*Difficulty: Remember/Understand*
*Section: 02.05*
*Topic: Cells*

49. "Adult" stem cells are more accurately called tissue-specific or somatic stem cells because
**A.** they are also present at prenatal stages of development.
B. some adults do not have them.
C. whether they are present or not in an adult depends upon the individual's level of maturity.
D. an adult body also contains embryonic stem cells.
E. "adult" implies that the cells are highly differentiated, and they are not.

*Difficulty: Apply/Analyze*
*Section: 02.05*
*Topic: Cells*

50. Human stem cells are valuable in drug development because they can be used to
A. create experimental organisms, such as rats and mice.
**B.** replace experimental animals such as rats and mice.
C. grow human embryos in culture, on which drugs can be tested.
D. study the latest stages of the disease that would have unfolded if the person hadn't died.
E. test doses of drugs so high that they would kill a person.

*Difficulty: Apply/Analyze*
*Section: 02.05*
*Topic: Cells*