*Biology for a Changing World 2e,* Chapter 10 Test Bank

1. How many alleles for a single trait are present in each human cell?

1. 1
2. 2
3. 23
4. 46
5. 4

Answer: B

DQ: What are mutations, and how can they occur?

Type: Know It

Difficulty: Easy

Important Words/Concepts: alleles on chromosomes

2. Alleles are located

1. on chromosome 17 only.
2. in random locations on chromosomes.
3. at a specific position on each of a pair of chromosomes.
4. on one chromosome of each pair.
5. on chromosomes 13 and 17.

Answer: C

DQ: What are mutations, and how can they occur?

Type: Know It

Difficulty: Easy

Important Words/Concepts: alleles on chromosomes

3. What is an example of a mutation in an allele?

1. a base change in the gene coding sequence
2. a base change in the gene’s regulatory regions
3. a deletion of a base within the gene
4. an insertion of a base within the gene
5. All of the above.

Answer: E

DQ: What are mutations, and how can they occur?

Type: Know It

Difficulty: Hard

Important Words/Concepts:alleles on chromosomes

4. How many copies of any particular gene does an individual human have?

1. 4
2. 1
3. 2
4. 46
5. 23

Answer: C

DQ: What are mutations, and how can they occur?

Type: Know It

Difficulty: Easy

Important Words/Concepts: genes, alleles, DNA

5. TRUE or FALSE:Different versions of a gene are called alleles; a mutation in a gene can create an allele.

*Answer:* True

DQ: What are mutations, and how can they occur?

Type: Know It

Difficulty: Easy

Important Words/Concepts: genes, alleles, DNA

6. Gene mutations can arise when nucleotides are

1. added to the gene.
2. taken away from the gene.
3. changed within the gene.
4. mismatched within the gene.
5. All of the above.

Answer: E

DQ: What are mutations, and how can they occur?

Type: Know It

Difficulty: Easy

Important Words/Concepts:genes, alleles, DNA

7. An allele is

1. any section of DNA.
2. a gene.
3. a specific section of a chromosome.
4. an alternate version of a gene.
5. a pair of genes.

Answer: D

DQ: What are mutations, and how can they occur?

Type: Know It

Difficulty: Easy

Important Words/Concepts:DNA, allele

8. Different alleles are the result of

1. mutations in RNA sequences.
2. any change in DNA sequences.
3. changes in DNA sequence within a gene.
4. changes in the size of a chromosome.
5. any kind of radiation damage.

Answer: C

DQ: What are mutations, and how can they occur?

Type: Know It

Difficulty: Easy

Important Words/Concepts: DNA, allele

9. How many different alleles of a gene like *BRCA1* can an individual have?

1. Several hundred, since there are hundreds of known *BRCA1* alleles
2. Four: two from their father and two from their mother
3. Only two: one from their father and one from their mother
4. One for males and hundreds for females
5. One for males and two for females

Answer: C

DQ: What are mutations, and how can they occur?

Type: Know It

Difficulty: Hard

Important Words/Concepts: DNA, allele

10. Mutations in a gene can lead to the development of new \_\_\_\_\_\_ for the gene.

*Answer:* alleles

DQ: What are mutations, and how can they occur?

Type: Use It

Difficulty: Easy

Important Words/Concepts:mutation, alleles

11. There are approximately \_\_\_\_\_\_\_\_\_\_ different alleles for the *BRCA1* gene.

* 1. 10
	2. 100
	3. 300
	4. 600
	5. 1000

Answer: D

DQ: What are mutations, and how can they occur?

Type: Know It

Difficulty: Hard

Important Words/Concepts:allele, *BRCA*

12. List three types of genetic mutations that may occur.

*Answer:* Mutations can arise from 1) extra nucleotides being inserted into a gene, 2) nucleotides being deleted from a gene, or 3) nucleotides being changed.

DQ: What are mutations, and how can they occur?

Type: Know It

Difficulty: Hard

Important Words/Concepts: allele, mutation

13. A mutation is best described as an error in

1. DNA.
2. mRNA.
3. protein.
4. enzymes.
5. cell division.

Answer: A

DQ: What are mutations, and how can they occur?

Type: Know It

Difficulty: Easy

Important Words/Concepts:allele, mutation

14. When copying DNA, DNA polymerase makes a mistake about every 10,000 to 100,000 nucleotides. Most of these mistakes, however, are corrected by repair enzymes so that mutations occur in only

1. 1 in 500,000 nucleotides.
2. 1 in 1 million nucleotides.
3. 1 in 10 million nucleotides.
4. 1 in 100 million nucleotides.
5. 1 in 1 billion nucleotides.

Answer: E

DQ: What are mutations, and how can they occur?

Type: Know It

Difficulty: Easy

Important Words/Concepts:allele, mutation

15. Most new alleles arise via

1. large rearrangements of genes.
2. exchanges of genes during crossing over.
3. mutations in existing genes.
4. changes in DNA polymerase that alter how polymerase copies DNA.
5. changes in the beginning and ending of a gene.

Answer: C

DQ: What are mutations, and how can they occur?

Type: Know It

Difficulty: Easy

Important Words/Concepts: allele, mutation

16. Bob and Linda are a newly married couple. They hope to have a child but are having trouble getting pregnant. They visit a fertility clinic, where they receive a variety of tests. One test shows that Bob is healthy but carries a single disease-causing allele for *CFTR* (the gene that can cause cystic fibrosis), but Linda does not. This means that

1. Bob’s DNA sequence for *CFTR* is different from Linda’s.
2. Bob has two different versions of the *CFTR* gene.
3. Linda does not have any copies of the *CFTR* gene.
4. Bob is unable to ever have children.
5. Both A and B

Answer: E

DQ: What are mutations, and how can they occur?

Type: Use It

Difficulty: Hard

Important Words/Concepts:allele, mutation

17. There are several different alleles for flower color in carnations. One of them causes white flowers; a different allele of the same gene causes red flowers. This means that all of the following are true, EXCEPT

1. white carnations have different DNA sequences than red carnations.
2. white carnations and red carnations have somewhat different proteins.
3. a carnation plant could have one copy of the white allele and one copy of the red allele.
4. a carnation plant could have two copies of the white allele and two copies of the red allele.
5. All of the above.

Answer: D

DQ: What are mutations, and how can they occur?

Type: Use It

Difficulty: Hard

Important Words/Concepts: allele, mutation

18. A newly identified mutation in mice, called “darkened dorsal,” causes a dark stripe along the mouse’s back. This mutation is located at a specific location on chromosome 2. A different sequence at this same chromosomal position results in a fur color pattern called “nonagouti.” Based on this information, darkened dorsal and nonagouti are different

1. genes for fur color.
2. alleles for the same gene.
3. mutations of the same chromosome.
4. chromatids.
5. All of the above.

Answer: B

DQ: What are mutations, and how can they occur?

Type: Use It

Difficulty: Hard

Important Words/Concepts: allele, mutation, chromosome

19. Which of the following is TRUE?

1. Alleles are usually harmful because they result from mutations.
2. Alleles are just different versions of the same gene.
3. Normal, healthy individuals don’t usually carry alleles.
4. An individual may have one, two, or three alleles for a particular trait.
5. None of the above.

Answer: B

DQ: What are mutations, and how can they occur?

Type: Know It

Difficulty: Easy

Important Words/Concepts: allele, mutation, chromosome

20. What would be the best way to distinguish between two alleles and two genes?

1. Examine the proteins they produce; most genes would produce very similar versions of the same protein, but two alleles would produce very different proteins.
2. Examine the proteins they produce; a gene produces one protein, and an allele produces two different proteins.
3. Examine their DNA; the DNA sequences of two different alleles would be more similar to each other than the sequences of two different genes.
4. You can’t distinguish between them; there’s no actual difference between alleles and genes.
5. Determine their chromosomal location; alleles will always be on different chromosomes, but genes will always be on different copies of the same chromosome.

Answer: C

DQ: What are mutations, and how can they occur?

Type: Use It

Difficulty: Hard

Important Words/Concepts: allele, mutation, chromosome

21. Doctors will screen individuals with a strong family history of breast cancer for mutations in the *BRCA1* gene. Explain why someone who does not test positive for a mutation can still be at risk for a *BRCA1* mutation and breast cancer.

*Answer:* There are more than 600 known mutations that can occur in *BRCA1*. Screening tests typically look for the most common mutations. Someone who has a rare mutation or a new mutation (one that is not tested for) may have a negative result in a screen but still have a mutation that was undetected.

DQ: What are mutations, and how can they occur?

Type: Use It

Difficulty: Hard

Important Words/Concepts: genes, mutation, breast cancer, genetic screen

22. A mutation would most likely be inherited if it is located in a \_\_\_\_ cell.

1. skin
2. body
3. sperm
4. liver
5. All of the above.

Answer: C

DQ: What are mutations, and how can they occur?

Type: Know It

Difficulty: Easy

Important Words/Concepts: mutations, heredity

23. Which sequence is the complementary DNA sequence of ATG GGC CTG?

1. ATG GGC CTG
2. TAC CCG GAG
3. TUC CCG GUC
4. TAC CCG GAC
5. TAC CCC GAC

Answer: D

DQ: What are mutations, and how can they occur?

Type: Know It

Difficulty: Easy

Important Words/Concepts**:** DNA replication

24. Which sequence is a result of a single mismatch in DNA replication of the sequence ATG GGC CTG?

1. ATG GGC CTC
2. AAG GGC CTC
3. TAC CCG GTC
4. TGC CCG GAG
5. TUC CCG GUC

Answer: C

DQ: What are mutations, and how can they occur?

Type: Know It

Difficulty: Easy

Important Words/Concepts: DNA replication and repair

25. The number of errors made by DNA polymerase during DNA replication that pass though the cell’s repair checkpoints is estimated at

1. 1 in 100 bases mismatched.
2. 1 in 1000 bases mismatched.
3. 1 in 1,000,000 bases mismatched.
4. 1 in 1,000,000,000 bases mismatched.
5. 1 in 10 bases mismatched.

Answer: D

DQ: What are mutations, and how can they occur?

Type: Use It

Difficulty: Hard

Important Words/Concepts: DNA replication and repair

26. The enzyme that copies DNA makes a mistake approximately every 10,000 to 100,000 bases. Surprisingly, however, if we examine newly copied DNA, we see that the actual error rate is lower than this. How is that possible?

1. The bases are self-correcting; the DNA will fix any errors as it is copied.
2. The cell is immediately killed if it contains a mistake in its DNA.
3. There are other enzymes that find errors in DNA and repair them.
4. All of the above.
5. None of the above.

Answer: C

DQ: What are mutations, and how can they occur?

Type: Use It

Difficulty: Easy

Important Words/Concepts: DNA repair, mutation

27. DNA mutations can

1. be detrimental.
2. be beneficial.
3. have no effect.
4. All of the above.
5. A or B only

Answer: D

DQ: What are mutations, and how can they occur?

Type: Know It

Difficulty: Easy

Important Words/Concepts:genes, alleles, DNA, mutations, junk DNA

28. Why aren’t all mutations that occur in DNA inherited by our offspring?

1. Only mutations in the DNA contained in the sperm and eggs will be inherited.
2. Each cell has different DNA in it, with only the genes that cell needs.
3. DNA that is mutated can’t be inherited; the cell corrects it before passing it on.
4. DNA that is inherited can’t have more than one mutation in it.
5. Some mutations occur in noncoding regions of genes, so they are not inherited.

Answer: A

DQ: What are mutations, and how can they occur?

Type: Know It

Difficulty: Easy

Important Words/Concepts: genes, alleles, DNA, mutations

29. What would happen if the enzyme that makes DNA added a nucleotide to the middle of a coding region of a gene?

1. It would change the reading frame of the DNA and possibly lead to a change in the amino acid sequence of the protein made from that gene.
2. It wouldn’t matter because it is in a coding region.
3. It is only one nucleotide so it wouldn’t matter; more than one nucleotide would need to be added to change a protein.
4. It would make longer mRNA and protein from that gene.
5. All of the above.

Answer: A

DQ: What are mutations, and how can they occur?

Type: Use It

Difficulty: Hard

Important Words/Concepts:DNA, mutation, nucleotide, frame, protein

30. Do all mutations that occur within the DNA sequence result in abnormal protein expression, and therefore affect the function of the protein?

1. Yes, regardless of the location of the mutation, protein expression and function will be adversely affected.
2. No, mutations occurring within the noncoding regions of the DNA sequence will not affect overall protein structure
3. No, DNA repair enzymes are designed specifically to “proofread” the DNA and they catch most mistakes
4. Yes, any mutations located within the DNA sequence will affect the structure of the protein.
5. B and C

Answer: E

DQ: What are mutations, and how can they occur?

Type: Know It

Difficulty: Hard

Important Words/Concepts: DNA, mutation, germ line, somatic cell

31. Which of the following cannot lead to a mutation?

1. replacing thymine with uracil when making RNA
2. deleting a portion of a gene
3. replacing thymine with guanine when copying DNA
4. inserting three base pairs into a gene
5. inserting one base pair into a gene

Answer: A

DQ: What are mutations, and how can they occur?

Type: Know It

Difficulty: Easy

Important Words/Concepts:mutation, DNA replication

32. DNA damage is usually repaired

1. in the egg or sperm cells before fertilization.
2. at or before checkpoints in the cell cycle.
3. in the ribosome during translation.
4. by the mitotic spindle.
5. by the complementary strand of DNA.

Answer: B

DQ: What are mutations, and how can they occur?

Type: Know It

Difficulty: Hard

Important Words/Concepts:DNA repair, checkpoints

33. How often do mistakes occur when copying DNA? Do all these mistakes appear in the final, copied DNA?

*Answer:* Mistakes occur between 1 in 10,000 times and 1 in 100,000 times, but repair enzymes fix all but about 1 per one billion of these mistakes.

DQ: What are mutations, and how can they occur?

Type: Use It

Difficulty: Easy

Important Words/Concepts: DNA repair, mutation, DNA replication

34. Why should pregnant women never be given X-rays?

*Answer:* X-ray radiation can damage DNA. A developing child is rapidly transcribing, translating, and copying its DNA, so any mutations to its DNA will either kill the child or those mutations will be copied and become prolific within the child’s body.

DQ: What are mutations, and how can they occur?

Type: Use It

Difficulty: Hard

Important Words/Concepts: allele, mutagen, mutation

35. Mutations are

1. always harmful.
2. never neutral.
3. always helpful.
4. never helpful.
5. sometimes harmful, sometimes helpful, and sometimes neutral.

Answer: E

DQ: What are mutations, and how can they occur?

Type: Know It

Difficulty: Easy

Important Words/Concepts: allele, mutation

36. Radioactive Man, a comic-book superhero, gained his abilities by falling into a vat of industrial toxic waste. Is this a likely outcome?

1. Yes, because mutations can be helpful, harmful, or neutral.
2. No, because most mutations are either harmful or neutral.
3. No, because toxic waste is not mutagenic.
4. No, because so many mutations would probably cause cancer or other disease.
5. Both B and D

Answer: E

DQ: What are mutations, and how can they occur?

Type: Use It

Difficulty: Hard

Important Words/Concepts: mutations, cancer, effect of mutations on proteins, mutagens

37. Amino acid sequences result from the process of

1. transcription.
2. translation.
3. replication.
4. regulation.
5. complementary base pairing.

Answer: B

DQ: What are mutations, and how can they occur?

Type: Know It

Difficulty: Easy

Important Words/Concepts: mutations in proteins causing disease, cancer

38. Mutations in DNA sequences may occur during the process of

1. transcription.
2. translation.
3. replication.
4. tumor suppression.
5. apoptosis.

Answer: C

DQ: What are mutations, and how can they occur?

Type: Know It

Difficulty: Easy

Important Words/Concepts:mutations in proteins causing disease

39. Substitution of a nucleotide base in the coding sequence of a gene may alter the protein’s

1. amino acid sequence.
2. 3D shape.
3. folding.
4. function.
5. All of the above.

Answer: E

DQ: What are mutations, and how can they occur?

Type: Know It

Difficulty: Hard

Important Words/Concepts: mutations in proteins causing disease

40. Why might a change in its amino acid sequence lead to a change in the way a protein functions?

1. Amino acids determine a protein’s shape. The wrong shape may not function normally.
2. A change in the amino acid sequence would not change the final protein.
3. A change in the amino acid sequence would cause a change in the DNA, which alters the protein.
4. A change in the amino acid sequence causes the DNA to pair incorrectly.
5. None of the above.

Answer: A

DQ: What are mutations, and how can they occur?

Type: Know It

Difficulty: Hard

Important Words/Concepts: DNA, mutation, germ line, somatic cell

41. How does a mutation in a noncoding region of DNA affect the final shape of the protein?

1. A mutation in a noncoding region would not affect the final protein shape, but it could affect gene regulation.
2. A change in the noncoding region leads to a change in amino acid sequence, which changes the way the protein folds.
3. A change in the amino acid sequence causes the DNA to pair incorrectly.
4. A change in the noncoding region causes the protein to fold “inside out.”
5. None of the above.

Answer: A

DQ: What are mutations, and how can they occur?

Type: Know It

Difficulty: Hard

Important Words/Concepts:DNA, mutation, coding, non-coding region, protein

42. Is the way a protein folds important for its function?

1. Yes, protein function depends on the protein’s 3-D structure.
2. Yes, because DNA mutations are caused by protein folding incorrectly.
3. No, as long as the sequence is correct.
4. No, as long as the protein is still soluble.
5. None of the above.

Answer: A

DQ: What are mutations, and how can they occur?

Type: Know It

Difficulty: Hard

Important Words/Concepts: DNA, mutation, protein, folding

43. Mutations in DNA occur during

1. transcription.
2. translation.
3. protein modification.
4. RNA duplication.
5. DNA duplication.

Answer: E

DQ: What are mutations, and how can they occur?

Type: Know It

Difficulty: Easy

Important Words/Concepts:mutation

44. Which of the following statements is always TRUE?

1. A mutation is harmful.
2. Mutations lead to changes in protein function.
3. Changes in DNA lead to changes in protein function.
4. A change in the DNA may change a protein’s shape and function.
5. A change in DNA will lead to cancer.

Answer: D

DQ: What are mutations, and how can they occur?

Type: Know It

Difficulty: Hard

Important Words/Concepts:mutation, protein function

45. How can changing the DNA sequence change a protein’s function?

*Answer:* Changes in DNA sequences mean that the RNA sequence will also be changed. If the RNA sequence is changed, the order of amino acids added to a protein will be changed. This may change the shape or size of the protein, thus changing its function.

DQ: What are mutations, and how can they occur?

Type: Use It

Difficulty: Easy

Important Words/Concepts:mutation, protein function

46. Which type of mutation do you think is most harmful to a cell, a base substitution (e.g., an A is replaced by a G) or a base insertion (e.g., ACG becomes ACTG)? Why?

*Answer:* A base insertion is most harmful to a cell because an insertion throws off the entire reading frame. Thus, every amino acid coded after the mutation will be incorrect. A base substitution, however, may result in either no change in the amino acid coded for or a change of only one amino acid.

DQ: What are mutations, and how can they occur?

Type: Use It

Difficulty: Hard

Important Words/Concepts:base insertion, base substitution, mutation

47. The Ashkenazi Jews have a higher rate of mutated alleles than the general public. All of the following are possible reasons for this, EXCEPT

1. in their Middle Eastern homeland, intense sunlight led to increased mutations.
2. they are descendants of a small number of individuals.
3. their population expanded and contracted.
4. members usually marry others within the same group.
5. new alleles were not introduced through intermarriage with other groups.

Answer: A

DQ: What are mutations, and how can they occur?

Type: Know It

Difficulty: Hard

Important Words/Concepts: inbreeding

48. Mutations usually affect a protein’s

1. size.
2. shape.
3. length.
4. electrical charge.
5. longevity.

Answer: B

DQ: What are mutations, and how can they occur?

Type: Know It

Difficulty: Hard

Important Words/Concepts: mutation, protein shape

49. If a mutation alters a protein, which of the following is NOT a likely outcome of the mutation?

1. The shape of the protein may be different.
2. The protein may function differently.
3. The protein may cause a disease or illness.
4. The protein may not function at all.
5. The protein may be repaired by enzymes.

Answer: E

DQ: What are mutations, and how can they occur?

Type: Use It

Difficulty: Easy

Important Words/Concepts: mutation, protein shape, DNA repair

50. Not all mutations are dangerous. Why?

1. Many mutations occur in noncoding regions.
2. Some mutations can have no effect on proteins.
3. Many DNA mutations are corrected by enzymes
4. Some cells don't use all their genes.
5. All of the above.

Answer: E

DQ: What are mutations, and how can they occur?

Type: Use It

Difficulty: Hard

Important Words/Concepts: mutations, DNA repair

51. If you consider most of the mutations that occur in your DNA, the majority have \_\_\_\_\_\_ effects.

1. few or no
2. helpful
3. harmful
4. reversible
5. lethal

Answer: A

DQ: What are mutations, and how can they occur?

Type: Know It

Difficulty: Hard

Important Words/Concepts: mutations, DNA repair

52. TRUE or FALSE: If you avoid dangerous chemicals and radiation for your entire life, you prevent all mutations in your DNA.

*Answer:* False

DQ: What are mutations, and how can they occur?

Type: Know It

Difficulty: Easy

Important Words/Concepts: mutations, DNA repair

53. What is the difference between a somatic cell mutation and a germ-line mutation?

A. Only mutations in germ-line cells can be passed on to offspring.

B. Only mutations in somatic cells can be passed on to offspring.

C. Somatic cell mutations cannot lead to cancer, but germ-line mutations can.

D. Germ-line mutations do not involve DNA, but somatic cell mutations do.

E. Somatic cell mutations do not involve DNA, but germ-line mutations do.

Answer: A

DQ: What are mutations, and how can they occur?

Type: Know It

Difficulty: Hard

Important Words/Concepts: DNA, mutation, germ-line, somatic cell

54. Which of the following is a mutagen?

1. UV light
2. smoking
3. blackened meats
4. excessive drinking
5. All of the above.

Answer: E

DQ: What are mutations, and how can they occur?

Type: Know It

Difficulty: Easy

Important Words/Concepts:mutagens, carcinogens, risk factors for cancer

55. If a person is a carrier for a disease; he or she has

1. one normal and one defective disease allele and is affected by the disease.
2. two defective disease alleles and is unaffected by the disease.
3. one normal and one defective disease allele and is unaffected by the disease.
4. two defective disease alleles and is affected by the disease.
5. two normal disease alleles and is affected by the disease.

Answer: C

DQ: What are mutations, and how can they occur?

Type: Know It

Difficulty: Easy

Important Words/Concepts: mutations, gene carriers

56. Why are Ashkenazi Jews more susceptible to certain hereditary diseases?

1. They have inherited predispositions and carcinogen exposure.
2. They have increased occupational exposure and environmental insults.
3. They are predisposed by exposure to occupational risks.
4. They have an increased carrier rate for these diseases from their ancestors.
5. They all have increased errors in DNA proofreading.

Answer: D

DQ: What are mutations, and how can they occur?

Type: Know It

Difficulty: Hard

Important Words/Concepts: mutations, carriers, founder effect, isolated populations, risk factors for disease

57. How can a person acquire mutations in their DNA?

1. inheritance
2. carcinogens
3. replication errors
4. mutagens
5. All of the above.

Answer: E

DQ: What are mutations, and how can they occur?

Type: Know It

Difficulty: Easy

Important Words/Concepts: DNA, mutation, carcinogen, mutagen

58. Which of the following is NOT a known source of mutations?

1. DNA repair or replication errors
2. chemical or environmental exposure
3. heredity
4. insufficient sleep and poor diet
5. None of the above; all are known sources of mutations

Answer: D

DQ: What are mutations, and how can they occur?

Type: Know It

Difficulty: Easy

Important Words/Concepts: DNA, mutation, carcinogen, mutagen, DNA replication and repair

59. Inherited mutations

1. predispose individuals to cancer.
2. come from DNA sequence mistakes contained in germ cells.
3. can come from one’s mother or father.
4. are errors in DNA that go uncorrected.
5. All of the above.

Answer: E

DQ: What are mutations, and how can they occur?

Type: Know It

Difficulty: Easy

Important Words/Concepts:DNA, mutation, carcinogen, mutagen

60. Which of the following is NOT a known carcinogen?

1. ultraviolet light
2. alcohol
3. charred food
4. smoking
5. None of the above; all are known carcinogens

Answer: E

DQ: What are mutations, and how can they occur?

Type: Know It

Difficulty: Easy

Important Words/Concepts**:** carcinogens

61. Which of the following are mutagens?

1. sunlight
2. cigarette smoke
3. alcohol
4. blackened meat
5. All of the above.

Answer: E

DQ: What are mutations, and how can they occur?

Type: Know It

Difficulty: Easy

Important Words/Concepts: mutagen, mutation

62. What is a mutagen?

*Answer:* A factor that increases the rate of mistakes made when copying DNA, or damages DNA and changes its sequence.

DQ: What are mutations, and how can they occur?

Type: Use It

Difficulty: Easy

Important Words/Concepts: mutagen, DNA repair

63. What are the three main ways a person can acquire a mutation in their DNA?

*Answer:* 1) inherited mutations, 2) mutations from uncorrected DNA errors, and 3) exposure to environmental mutagens

DQ: What are mutations, and how can they occur?

Type: Know It

Difficulty: Easy

Important Words/Concepts: mutation sources

64. Which of the following will lead to a new, inheritable allele?

1. a mutation in a sperm cell
2. a mutation in an egg cell
3. a mutation in an embryo
4. a mutation in the brain
5. All of the above. except D

Answer: E

DQ: What are mutations, and how can they occur?

Type: Know It

Difficulty: Easy

Important Words/Concepts: allele, mutation

65. For a mutation to become an allele it must occur in one of three possible locations. What are those three?

*Answer:* in the sperm, egg, or early stages of a developing embryo

DQ: What are mutations, and how can they occur?

Type: Know It

Difficulty: Easy

Important Words/Concepts: allele, mutation

66. A woman with normal *BRCA* alleles has a child with a man who has one mutated *BRCA1* allele. What is the probability that the child will have a mutated *BRCA1* allele?

1. 0%
2. 25%
3. 50%
4. 75%
5. 100%

Answer: C

DQ: What are mutations, and how can they occur?

Type: Use It

Difficulty: Hard

Important Words/Concepts: *BRCA*, cancer risk, mutation

67. TRUE or FALSE**:** To get cancer, all you need is a mutation in one essential gene.

*Answer:* False

DQ: What are mutations, and how can they occur?

Type: Use It

Difficulty: Medium

Important Words/Concepts: tumor formation; mutation; multi-hit hypothesis

68. In a cell with the following mutations, which would you expect to be MOST likely to cause tumors?

1. *BRCA1* and *BRCA2*
2. *BRCA1* and *p53* mutation
3. *BRCA1*, *BRCA2*, *Her2*, and *p53* mutations
4. *BRCA1*, *BRCA2*, and *p53* mutations
5. *BRCA1*, *Her2*, and *p53* mutations

Answer: C

DQ: What are mutations, and how can they occur?

Type: Know It

Difficulty: Hard

Important Words/Concepts: tumorigenesis, oncogenes, tumor-suppressor genes

69. Which combination(s) of mutated genes would be most likely to make a cell cancerous?

1. one oncogene
2. one tumor suppressor gene
3. two oncogenes
4. two oncogenes and two tumor-suppressor genes
5. All of the above.

Answer: D

DQ: What are mutations, and how can they occur?

Type: Use It

Difficulty: Easy

Important Words/Concepts: tumorigenesis, oncogenes, tumor-suppressor genes

70. In a cell with the following mutations, which would you expect to be LEAST likely?

1. *BRCA1* and *BRCA2*
2. *BRCA1*
3. *BRCA1*, *BRCA2*, *Her2*, and *p53* mutations
4. *BRCA1*, *BRCA2*, and *p53* mutations
5. *BRCA1*, *Her2*, and *p53* mutation

Answer: B

DQ: What are mutations, and how can they occur?

Type: Know It

Difficulty: Easy

Important Words/Concepts: tumorigenesis, oncogenes, tumor-suppressor genes

71. What is the number-one preventable cause of cancer?

1. smoking
2. UV light exposure
3. grilled meats and vegetables
4. pollution exposure
5. alcohol

Answer: A

DQ: How does cancer develop, and how can people reduce their risk?

Type: Use It

Difficulty: Hard

Important Words/Concepts: DNA, mutation, smoking, carcinogen

72. The most common cancer among women is

1. prostate cancer.
2. breast cancer.
3. ovarian cancer.
4. nonmelanoma skin cancer.
5. lung cancer.

Answer: D

DQ: How does cancer develop, and how can people reduce their risk?

Type: Know It

Difficulty: Easy

Important Words/Concepts:cancer

73. A normal *BRCA1* allele produces normal protein that

* 1. inhibits transcription.
	2. inhibits translation.
	3. ensures correct, error-free DNA transcription.
	4. allows cells to repair DNA damage.
	5. recognizes and destroys incorrectly translated proteins.

Answer: D

DQ: How does cancer develop, and how can people reduce their risk?

Type: Know It

Difficulty: Hard

Important Words/Concepts: allele, *BRCA,* protein

74. All of the following are TRUE of breast cancer, EXCEPT

1. it is the second-most common form of cancer in women.
2. mutations in the *BRCA* genes affect only the breasts and ovaries.
3. *BRCA* mutations cause only about 50% of all hereditary breast cancers.
4. it affects about 200,000 women in the United States per year.
5. a woman may pass the predisposition for breast cancer to her children.

Answer: B

DQ: How does cancer develop, and how can people reduce their risk?

Type: Know It

Difficulty: Hard

Important Words/Concepts: allele, breast cancer

75. All of the following are TRUE of *BRCA* genes, EXCEPT

1. there are two genes, and a mutation in either can lead to cancer.
2. when mutated, they produce proteins that are unable to regulate the cell cycle.
3. just one mutated *BRCA* gene increases a woman’s lifetime cancer risk to greater than 90%.
4. mutations in *BRCA* genes can lead to either breast or ovarian cancer in women.
5. mutations in *BRCA* genes can lead to prostate cancer in men.

Answer: C

DQ: How does cancer develop, and how can people reduce their risk?

Type: Know It

Difficulty: Hard

Important Words/Concepts: allele, *BRCA*

76. Which of the following would most likely increase an individual’s risk of cancer?

1. a mutation in the noncoding region of DNA
2. a mutation in their mother’s somatic cells
3. a mutation in a gene for a DNA repairing enzyme
4. an error in transcribing DNA into RNA
5. All of the above.

Answer: C

DQ: How does cancer develop, and how can people reduce their risk?

Type: Use It

Difficulty: Hard

Important Words/Concepts: mutation, DNA replication, somatic cells

77. Which of the following types of mutations is LEAST likely to lead to cancer?

1. a mutation of proto-oncogenes
2. a mutation of tumor suppressor genes
3. a mutation of a gene that codes for DNA polymerase
4. a mutation of a gene that codes for DNA repair enzymes
5. a mutation in a noncoding sequence of a gene

Answer: E

DQ: How does cancer develop, and how can people reduce their risk?

Type: Use It

Difficulty: Hard

Important Words/Concepts: allele, mutation

78. Even though DNA repair enzymes correct most errors, approximately 1 in every one billion nucleotides still contains an error. The human genome, however, is 3 billion bases long. In an average adult, there are 50 trillion to 100 trillion cells, all of which contain these 3 billion bases, and these trillions of cells divide all the time. Given all this, why do you think people don’t have cancer more often?

*Answer:* Many mutations occur in noncoding regions, thus, they do not affect proteins. Furthermore, most mutations in coding regions are corrected by repair enzymes, and those that are not can sometimes be neutral or even helpful.

DQ: How does cancer develop, and how can people reduce their risk?

Type: Use It

Difficulty: Hard

Important Words/Concepts: mutation

79. A gene found in a somatic cell is mutated. The resulting protein regulates mitosis but now has a different 3D shape. What is a likely result?

1. germ-line mutations
2. hereditary mutations
3. cancer
4. down syndrome
5. cystic fibrosis

Answer: C

DQ: How does cancer develop, and how can people reduce their risk?

Type: Use It

Difficulty: Easy

Important Words/Concepts: mutations in proteins causing disease, cancer, mitosis, mutation

80. Explain how alterations of the *BRCA* proteins could lead to cancer.

*Answer:* Cancer is uncontrolled cell division. Normal *BRCA* proteins regulate the cell cycle and prevent uncontrolled cell division. Altered versions of *BRCA* proteins do not function properly; thus, they fail to prevent cells from dividing, which in turn can lead to cancer.

DQ: How does cancer develop, and how can people reduce their risk?

Type: Use It

Difficulty: Hard

Important Words/Concepts:*BRCA*

81. Which of these does NOT *directly* cause cancer?

1. inherited predispositions
2. solar radiation (UV)
3. tobacco smoking or chewing
4. DNA damage from viruses
5. mutagens in drinking water

Answer: A

DQ: How does cancer develop, and how can people reduce their risk?

Type: Know It

Difficulty: Easy

Important Words/Concepts: mutations, mutagens, carcinogens, germ-line mutations, DNA repair, risk factors for cancer

82. Which occupation is high risk for a predisposition to cancer?

1. chimney sweeping
2. coal mining
3. cabinet making
4. shoe repair and manufacture
5. All of the above.

Answer: E

DQ: How does cancer develop, and how can people reduce their risk?

Type: Use It

Difficulty: Easy

Important Words/Concepts: mutations in your DNA

83. If one has an inherited allele known to be linked to an increased risk of cancer, what are some suggestions to lower the risk?

*Answer:* Answers will vary, but generally, avoid exposure to known environmental mutagens and carcinogens. Cancer is a result of an accumulation of mutations, so limit exposure (occupational or recreational) to any DNA-damaging agents.

DQ: How does cancer develop, and how can people reduce their risk?

Type: Use It

Difficulty: Easy

Important Words/Concepts: mutations in your DNA

84. Somatic cells are

1. cancer cells.
2. cells that become tumors.
3. cells that become eggs.
4. cells that become sperm.
5. cells that do not become reproductive cells.

Answer: E

DQ: How does cancer develop, and how can people reduce their risk?

Type: Know It

Difficulty: Easy

Important Words/Concepts: somatic cells

85. Which of the following statements is FALSE?

1. All carcinogens are mutagens.
2. Some cancers are hereditary.
3. All mutations can cause cancer.
4. Ultraviolet light can lead to skin cancers, so it is a mutagen.
5. Ultraviolet light can lead to skin cancers, so it is a carcinogen.

Answer: C

DQ: How does cancer develop, and how can people reduce their risk?

Type: Know It

Difficulty: Hard

Important Words/Concepts: mutagen, carcinogen, mutation, cancer

86. What is a carcinogen?

 *Answer:* A mutagen that has been linked with causing mistakes that lead to cancer.

DQ: How does cancer develop, and how can people reduce their risk?

Type: Use It

Difficulty: Easy

Important Words/Concepts: carcinogen

87. List at least five carcinogens.

*Answer:*Alcohol, smoking, UV exposure, various pollutant chemicals (like petroleum), charred foods, pesticides in food

DQ: How does cancer develop, and how can people reduce their risk?

Type: Use It

Difficulty: Easy

Important Words/Concepts: carcinogen

88. Skin cancer is the result of changes in DNA, but it is not usually passed on to the next generation. Explain why it is not passed on.

*Answer:* Skin cancer occurs in somatic cells, which are cells that are not part of the process of producing reproductive cells.

DQ: How does cancer develop, and how can people reduce their risk?

Type: Use It

Difficulty: Easy

Important Words/Concepts: somatic cells

89. You have just had a *BRCA* analysis, in which your doctor ran tests to check for abnormal *BRCA* alleles. You learn that you have a *BRCA* allele that has been associated with cancer. Neither of your parents has this allele. How could this occur?

*Answer:* While many alleles are passed on from generation to generation, anytime we make a new cell, there is a chance of mistakes occurring. As an embryo, we are a ball of rapidly dividing cells, so the mutation could have occurred during embryonic development, thus passing on the mutation to all descendants of the first mutated cell. If the mutation isn’t widespread, it could be a somatic mutation.

DQ: How does cancer develop, and how can people reduce their risk?

Type: Use It

Difficulty: Hard

Important Words/Concepts: *BRCA* analysis, mutation, heredity

90. You’ve just received the results of your *BRCA* analysis (a check for abnormal *BRCA* alleles). The results say that you carry one normal *BRCA1* allele and one *BRCA1* allele associated with cancer, and two *BRCA2* alleles that are associated with cancer. Does this mean you will get cancer? Explain.

*Answer:* The results indicate that you are more likely to get cancer than someone with all dominant, normal alleles for both genes. However, it is not a diagnosis that you WILL get cancer. Your exposure to cancer risk factors plus the exact nature of the mutated alleles will increase or decrease your chances of getting cancer.

DQ: How does cancer develop, and how can people reduce their risk?

Type: Use It

Difficulty: Hard

Important Words/Concepts: *BRCA* analysis

91. DNA insertions can have significant effects on an organism. How can adding DNA cause an impact?

*Answer:* DNA is interpreted in codons composed of three nitrogenous bases. Each codon codes for a specific amino acid. If even one extra base is inserted, it will alter the codons. For example, if the sequence read AAACCCGGG, that would be three codons—AAA, CCC, and GGG. If a C was inserted (e.g., ACAACCCGGG) it would change the codons to ACA, ACC, and CGG.

DQ: How does cancer develop, and how can people reduce their risk?

Type: Use It

Difficulty: Hard

Important Words/Concepts: DNA sequence, translation, DNA insertions

92. A woman who desires children but is about to undergo chemotherapy is told by her doctor that she should consider having several of her eggs removed and stored for future use. Why might a doctor encourage her to do this?

*Answer:* Because all the eggs a woman will ever ovulate are already present in her body when she is born, undergoing chemotherapy can damage those eggs and she may never be able to have a child using those eggs. Removing several and freezing them for future use ensures that at least some of her eggs are likely to remain viable.

DQ: How does cancer develop, and how can people reduce their risk?

Type: Use It

Difficulty: Easy

Important Words/Concepts: mutation

93. Which of the following is most likely to be an INHERITED cancer?

1. skin cancer
2. liver cancer
3. lung cancer
4. prostate cancer
5. stomach cancer

Answer: D

DQ: How does cancer develop, and how can people reduce their risk?

Type: Know It

Difficulty: Hard

Important Words/Concepts: mutagen, mutation

94. A new gene is discovered, called GRAB. It prevents a cell from entering mitosis if there are any signs of DNA damage. This means that GRAB would be a type of

1. oncogene.
2. tumor-suppressor gene.
3. nonhereditary gene.
4. somatic gene.
5. proto-oncogene.

Answer: B

DQ: How does cancer develop, and how can people reduce their risk?

Type: Know It

Difficulty: Easy

Important Words/Concepts: cell cycle genes, checkpoints, mitosis, mutation

95. What kind of mutation causes most types of cancer?

1. mutations in skin cells
2. mutations in transcription factors
3. mutations in blood cells
4. mutations in cell cycle genes
5. None of the above.

Answer: D

DQ: How does cancer develop, and how can people reduce their risk?

Type: Know It

Difficulty: Hard

Important Words/Concepts: DNA, mutation, carcinogen, mutagen, checkpoints

96. Many cells in your body stop at the G1 checkpoint and never divide again.  Some cells, like skin cells, will continue past the G1 checkpoint.  What types of genes tell a skin cell to move on past the G1 checkpoint?

1. proto-oncogenes
2. tumor-suppressor genes
3. cell-enhancing genes
4. oncogenes
5. tumor-deflecting genes

Answer: A

DQ: How does cancer develop, and how can people reduce their risk?

Type: Know It

Difficulty: Easy

Important Words/Concepts: proto-oncogenes, oncogenes, checkpoints

97. In healthy cells, if a mutation occurs in a proto-oncogene, what is the gene now termed?

1. tumor regulator
2. *Her2*
3. cell-cycle regulator
4. tumor suppressor
5. oncogene

Answer: E

DQ: How does cancer develop, and how can people reduce their risk?

Type: Know It

Difficulty: Easy

Important Words/Concepts: proto-oncogenes, oncogenes, tumor-suppressor genes

98. Proto-oncogenes are

1. tumor regulators.
2. required for normal cell division.
3. tumor suppressors.
4. cancer causing in normal cells.
5. mutations in oncogenes.

Answer: B

DQ: How does cancer develop, and how can people reduce their risk?

Type: Know It

Difficulty: Easy

Important Words/Concepts: proto-oncogenes, oncogenes, tumor-suppressor genes

99. In normal cells, tumor suppressors are

1. oncogenes.
2. not required.
3. carcinogens.
4. required for DNA repair or programmed cell death.
5. underexpressed.

Answer: D

DQ: How does cancer develop, and how can people reduce their risk?

Type: Know It

Difficulty: Easy

Important Words/Concepts: proto-oncogenes, oncogenes, tumor-suppressor genes

100. Permanent activation or overexpression of proto-oncogenes

1. turns tumor suppressors off.
2. is required for normal cell division.
3. has been linked to breast cancer.
4. keeps a cell from dividing.
5. turns tumor suppressors on.

Answer: C

DQ: How does cancer develop, and how can people reduce their risk?

Type: Know It

Difficulty: Hard

Important Words/Concepts: proto-oncogenes, oncogenes, tumor-suppressor genes

101. In normal cells, lack of functional tumor suppressors would cause

1. an accumulation of mutations in the DNA.
2. division of damaged cells.
3. cancer, possibly.
4. uncontrolled cell division.
5. All of the above.

Answer: E

DQ: How does cancer develop, and how can people reduce their risk?

Type: Know It

Difficulty: Hard

Important Words/Concepts: proto-oncogenes, oncogenes, tumor-suppressor genes

102. Apoptosis can be described as

1. division of damaged cells.
2. abnormal cell behavior.
3. uncontrollable cell division.
4. programmed cell death.
5. immortalization of cells.

Answer: D

DQ: How does cancer develop, and how can people reduce their risk?

Type: Know It

Difficulty: Hard

Important Words/Concepts: proto-oncogenes and tumor-suppressor genes

103. A proto-oncogene is a gene that

1. tells the cell when to stop the cell cycle.
2. is responsible for DNA repair.
3. is responsible for detecting mutations.
4. tells the cell to go through the cell cycle.
5. causes apoptosis.

Answer: D

DQ: How does cancer develop, and how can people reduce their risk?

Type: Know It

Difficulty: Easy

Important Words/Concepts: DNA, mutation, proto-oncogene, tumor-suppressor gene

104. A tumor suppressor gene is a gene that

1. tells the cell when to stop the cell cycle.
2. is responsible for DNA repair.
3. is responsible for detecting mutations.
4. tells the cell to go through the cell cycle.
5. prevents apoptosis from occurring.

Answer: A

DQ: How does cancer develop, and how can people reduce their risk?

Type: Know It

Difficulty: Easy

Important Words/Concepts: DNA, mutation, proto-oncogene, tumor-suppressor gene

105. When would you need a gene that can stop the cell cycle?

1. when a mutation occurred and the cell needed time to repair it before continuing
2. when there was no immediate need for more cells
3. when a cell had completed DNA replication
4. A and C only
5. A and B only

Answer: E

DQ: How does cancer develop, and how can people reduce their risk?

Type: Use It

Difficulty: Hard

Important Words/Concepts: DNA, mutation, proto-oncogene, tumor-suppressor gene

106. What would happen if a tumor suppressor, such as *BRCA1*, was mutated?

1. DNA may not be able to be repaired.
2. The cell cycle could continue without stopping when needed.
3. Cells would stop dividing and be unable to get through the cell cycle.
4. A and B only
5. All of the above.

Answer: D

DQ: How does cancer develop, and how can people reduce their risk?

Type: Use It

Difficulty: Hard

Important Words/Concepts: DNA, mutation, proto-oncogene, tumor-suppressor gene, *BRCA1*

107. What would happen if a proto-oncogene, such as *Her2*, were mutated?

1. DNA may not be able to be repaired.
2. The cell cycle would continue without stopping when needed.
3. Cells would stop dividing and be unable to get through the cell cycle.
4. A and B only
5. All of the above.

Answer: B

DQ: How does cancer develop, and how can people reduce their risk?

Type: Use It

Difficulty: Hard

Important Words/Concepts: DNA, mutation, proto-oncogene, tumor-suppressor gene, *Her2*

108. Which of the following would NOT lead to cancer?

1. an active oncogene
2. a misshapen tumor-suppressor protein
3. a mutated proto-oncogene
4. a tumor-suppressor allele missing 20% of its bases
5. An active proto-oncogene

Answer: E

DQ: How does cancer develop, and how can people reduce their risk?

Type: Use It

Difficulty: Hard

Important Words/Concepts: DNA, mutation, proto-oncogene, tumor-suppressor gene

109. Under normal conditions, when a cell has too much DNA damage to be repaired, what happens?

*Answer:* Tumor-suppressing genes make proteins that target the cell for self destruction.

DQ: How does cancer develop, and how can people reduce their risk?

Type: Use It

Difficulty: Easy

Important Words/Concepts: cell destruction

110. Explain the difference between an oncogene and a proto-oncogene. How is this related to cancer?

*Answer:* An oncogene is an overactive proto-oncogene, one that is always in the “on” position. Since proto-oncogenes are the genes that tell a cell to begin the process of dividing, an oncogene starts the process of cell division in cells that would not normally divide. This can result in cancer, which is uncontrolled cell division.

DQ: How does cancer develop, and how can people reduce their risk?

Type: Use It

Difficulty: Hard

Important Words/Concepts: oncogene, proto-oncogene, cancer

111. Mutations that cause the cell to divide rapidly, even in the absence of a signal to divide, are usually mutations of

1. proto-oncogenes.
2. tumor-suppressor genes.
3. DNA polymerase.
4. cell-surface proteins.
5. DNA-repair enzymes.

Answer: A

DQ: How does cancer develop, and how can people reduce their risk?

Type: Know It

Difficulty: Hard

Important Words/Concepts: mutation, proto-oncogene, cancer, cell cycle

112. Tumor-suppressor genes can act by making proteins that

1. repair damaged DNA.
2. stop the cell from dividing when there are problems.
3. induce apoptosis.
4. cause cell death.
5. All of the above.

Answer: E

DQ: How does cancer develop, and how can people reduce their risk?

Type: Know It

Difficulty: Easy

Important Words/Concepts: tumor-suppressor gene, cell death, DNA repair, apoptosis, cancer

113. There are two classes of genes that, when mutated, frequently lead to cancer. Which class of these two types of genes promotes cell division and differentiation, and which class of genes inhibits the cell cycle in order to make repairs?

*Answer:* Proto-oncogenes promote cell division and differentiation, while tumor-suppressor genes inhibit the cell cycle in order to make repairs.

DQ: How does cancer develop, and how can people reduce their risk?

Type: Know It

Difficulty: Hard

Important Words/Concepts: mutation, proto-oncogene, tumor-suppressor gene

114. *BRCA1* and *BRCA2* are \_\_\_\_\_\_\_\_\_\_\_, *p53* is a \_\_\_\_\_\_\_\_\_\_\_, and *Her2* is a \_\_\_\_\_\_\_\_\_\_.

1. tumor-suppressor genes, tumor-suppressor gene, proto-oncogene
2. tumor-suppressor genes; proto-oncogene; tumor-suppressor gene
3. proto-oncogenes; tumor-suppressor gene; proto-oncogene
4. proto-oncogenes; tumor-suppressor gene; tumor-suppressor gene
5. proto-oncogenes; proto-oncogene; tumor-suppressor gene

Answer: A

DQ: How does cancer develop, and how can people reduce their risk?

Type: Know It

Difficulty: Hard

Important Words/Concepts: *BRCA*, proto-oncogene, tumor suppressor gene, *Her2*, *p53*

115. You isolate cells from a tumor and study them. You observe that the cells continue dividing, even when DNA is damaged, when the cells become crowded, or even when nutrients run low. These observations lead you to suspect that the cells

1. contain a proto-oncogene.
2. contain an oncogene.
3. contain a mutated tumor-suppressor gene.
4. are infected by a virus.
5. are breast-cancer cells.

Answer: C

DQ: How does cancer develop, and how can people reduce their risk?

Type: Use It

Difficulty: Hard

Important Words/Concepts:proto-oncogene, tumor suppressor gene, *Her2*

117. TRUE or FALSE**:** To get cancer, all you need is a mutation in one essential gene.

*Answer:* False

DQ: How does cancer develop, and how can people reduce their risk?

Type: Use It

Difficulty: Medium

Important Words/Concepts: tumor formation; mutation; multi-hit hypothesis

118. In a cell with the following mutations, which would you expect to be MOST likely to cause tumors?

1. *BRCA1* and *BRCA2*
2. *BRCA1* and *p53* mutation
3. *BRCA1*, *BRCA2*, *Her2*, and *p53* mutations
4. *BRCA1*, *BRCA2*, and *p53* mutations
5. *BRCA1*, *Her2*, and *p53* mutations

Answer: C

DQ: How does cancer develop, and how can people reduce their risk?

Type: Know It

Difficulty: Hard

Important Words/Concepts:tumorigenesis, oncogenes, tumor-suppressor genes

119. Which combination(s) of mutated genes would be most likely to make a cell cancerous?

1. one oncogene
2. one tumor suppressor gene
3. two oncogenes
4. two oncogenes and two tumor-suppressor genes
5. All of the above.

Answer: D

DQ: How does cancer develop, and how can people reduce their risk?

Type: Use It

Difficulty: Easy

Important Words/Concepts:tumorigenesis, oncogenes, tumor-suppressor genes

120. Which set of mutations in a cell would you expect to be LEAST tumorigenic?

1. *BRCA1* and *BRCA2*
2. *BRCA1*
3. *BRCA1*, *BRCA2*, *Her2*, and *p53* mutations
4. *BRCA1*, *BRCA2*, and *p53* mutations
5. *BRCA1*, *Her2*, and *p53* mutation

Answer: B

DQ: How does cancer develop, and how can people reduce their risk?

Type: Know It

Difficulty: Easy

Important Words/Concepts: tumorigenesis, oncogenes, tumor-suppressor genes

121. A mutation in one cancer-related gene is not enough to cause a cell to become cancerous. Why?

1. We have more than two copies of every gene.
2. Cell division is controlled by many proteins, not just one.
3. We have two copies of every gene.
4. Nearby cells will repair the mutation.
5. The cell has to divide more times to become cancerous.

Answer: B

DQ: How does cancer develop, and how can people reduce their risk?

Type: Know It

Difficulty: Easy

Important Words/Concepts: DNA, mutation, proto-oncogene, tumor-suppressor gene

122. Which of the following steps (in order) would most likely lead to tumor formation?

1. A mutation in a single cell-cycle gene occurs, then the cell rapidly divides and spreads.
2. A mutated tumor-suppressor gene is inherited, several proto-oncogenes become mutated, and the cell dies.
3. A mutation in a cell-cycle gene occurs, then shortly afterwards the cell dies.
4. A mutated tumor-suppressor gene is inherited, other mutations in proto-oncogenes occur, and the cell rapidly divides and spreads.
5. A proto-oncogene is inherited, mutation converts it into an oncogene, and the cell rapidly divides and spreads.

Answer: D

DQ: How does cancer develop, and how can people reduce their risk?

Type: Use It

Difficulty: Hard

Important Words/Concepts: DNA, mutation, proto-oncogene, tumor-suppressor gene, tumor

123. Why does cancer affect older individuals more frequently than younger people?

1. Older people have more genes then younger people, so the tendency for the genes to be mutated increases.
2. Cells become more fragile and die more rapidly as people age.
3. Older people tend to smoke, which is a carcinogen and causes cancer.
4. Older people have had more time to accumulate mutations from various sources.
5. Older DNA is more susceptible to mutation than younger DNA.

Answer: D

DQ: How does cancer develop, and how can people reduce their risk?

Type: Use It

Difficulty: Easy

Important Words/Concepts: DNA, mutation, age, tumor

124. What is the difference between mutagens and carcinogens?

1. All mutagens are carcinogens.
2. All carcinogens are mutagens.
3. Carcinogens are any substance that damages DNA and can lead to cancer.
4. B and C
5. None of the above; they are the same thing with different names

Answer: D

DQ: How does cancer develop, and how can people reduce their risk?

Type: Use It

Difficulty: Easy

Important Words/Concepts: mutagen, carcinogen, chemical, cancer

125. What role does an oncogene play in generating a tumor?

*Answer:* A tumor is a mass of cells resulting from rapid cell division. Oncogenes stimulate uncontrolled cell division.

DQ: How does cancer develop, and how can people reduce their risk?

Type: Use It

Difficulty: Easy

Important Words/Concepts: oncogene, tumor

126. Predict what would most likely happen in a cell if *BRCA1* were mutated.

1. DNA errors would occur more frequently.
2. The cell would divide much faster.
3. Tumors would form immediately.
4. The cell would pause forever and wait for damage to be repaired.
5. The cell would copy DNA faster and more accurately.

Answer: A

DQ: How does cancer develop, and how can people reduce their risk?

Type: Use It

Difficulty: Hard

Important Words/Concepts: mutation rate, cancer, *BRCA1*, DNA repair

127. Why do people become more likely to develop cancer as they age?

*Answer:* Because the older they are, the more carcinogens they may have been exposed to and the more cell divisions their cells have undergone, and therefore, the more likely mutations are to have occurred and accumulated.

DQ: How does cancer develop, and how can people reduce their risk?

Type: Know It

Difficulty: Hard

Important Words/Concepts: cancer risk, mutation

128. You are accidentally exposed to high levels of radiation in the upper part of your body that damaged your DNA and caused you to develop throat cancer. You are concerned that you will pass these mutations on to your children. Should you be concerned? Why or why not?

*Answer:* You likely have no reason to be concerned because the mutations affected your throat, not your reproductive cells. Only mutations in sperm, egg, or in a developing embryo will affect your children.

DQ: Why do people with “inherited” cancer often develop cancer at a relatively young age?

Type: Use It

Difficulty: Hard

Important Words/Concepts: allele, mutagen, mutation

129. “A person who inherits a mutation in a cell cycle regulatory gene will develop cancer.” Is this a true statement? Explain.

*Answer:* It takes more than one mutation to develop cancer, so a mutation in one

gene, regardless of what it does, is not enough to cause cancer.

DQ: Why do people with “inherited” cancer often develop cancer at a relatively young age?

Type: Know It

Difficulty: Easy

Important Words/Concepts:DNA, mutation, cancer, cell cycle

130. You learn from DNA testing that for *BRCA1* you have one normal allele and one allele associated with cancer. For *BRCA2*, you have two alleles associated with cancer. How does this affect your risk for cancer?

1. Your risk is the same as any other average human being.
2. You will almost certainly get cancer at a very young age.
3. Your risk is definitely higher than for someone with all mutant alleles for *BRCA1* and *BRCA2*.
4. Your risk is the same as that for someone with a single mutant *BRCA1* allele.
5. Your risk is higher than average but depends on other genes you carry and your lifestyle.

Answer: E

DQ: Why do people with “inherited” cancer often develop cancer at a relatively young age?

Type: Use It

Difficulty: Hard

Important Words/Concepts: *BRCA*, risk factors, cancer

131. The mutant *BRCA2* gene predisposes people to cancer. If mutant *BRCA2* runs in Isadora’s family, will she automatically get cancer?

1. Yes, because genes like *BRCA2* are always inherited if one of your parents has a mutation.
2. No. Although inherited genes may carry an increased predisposition toward cancer, it is often nonhereditary mutations that lead to cancer.
3. Yes, because inherited genes that are mutated will cause cancer.
4. No, because more than one mutation is needed to develop cancer.
5. B and D

Answer: E

DQ: Why do people with “inherited” cancer often develop cancer at a relatively young age?

Type: Know It

Difficulty: Hard

Important Words/Concepts**:** DNA, mutation, germ line, somatic cell

132. Why do people with inheritable high-risk mutations develop cancer at an earlier age?

1. People who have inherited high-risk mutations start life with at least one predisposing mutation, so they require fewer additional mutations.
2. People who have inherited high-risk mutations always have other environmental risk factors putting them at higher risk for developing cancer at a younger age.
3. People with inheritable high-risk mutations start expressing the mutated genes at a younger age.
4. The inherited mutations cause new mutations to occur more easily.
5. All the above.

Answer: A

DQ: Why do people with “inherited” cancer often develop cancer at a relatively young age?

Type: Use It

Difficulty: Easy

Important Words/Concepts:DNA, mutation, age, tumor

133. What factors have made the Ashkenazi Jewish population more susceptible to genetic diseases?

1. They descended from a small group of people.
2. The population has expanded and contracted over time.
3. They tend to marry other Ashkenazis.
4. B and C
5. All the above.

Answer: E

DQ: Why do people with “inherited” cancer often develop cancer at a relatively young age?

Type: Use It

Difficulty: Easy

Important Words/Concepts: DNA, mutation, genetic disease, Ashkenazi Jewish

134. You have a family history of breast cancer and your doctor has just confirmed that you have several alleles that have been linked to cancer. Is there anything you can do to avoid cancer? Explain.

*Answer:* The genetic predisposition to cancer does not automatically mean you will develop cancer. If you have such a disposition, it is important that you reduce or eliminate all known mutagens and carcinogens from your life, as well as avoiding alcohol and smoking, maintaining a healthy weight, eating a healthful diet, etc.

DQ: Why do people with “inherited” cancer often develop cancer at a relatively young age?

Type: Use It

Difficulty: Hard

Important Words/Concepts: cancer risk factors

135. How can mutations in *BRCA1* lead to an accumulation of mutations in the cell?

*Answer:* Even when everything is functioning properly, initial mistakes in copying DNA occur at a rate of 1/10,000 to 1/100,000. Genes like *BRCA1* edit or destroy those mistakes, reducing the final mistake rate to about 1/billion. However, if a mutation occurs that causes genes like *BRCA1* to malfunction, many more of the initial mistakes will make it through the editing stages, causes a rapid accumulation of mutations.

DQ: Why do people with “inherited” cancer often develop cancer at a relatively young age?

Type: Use It

Difficulty: Hard

Important Words/Concepts: mutation rate

136. What is the role of estrogen in a woman’s risk of developing breast cancer, especially if she has a mutation in one of her *BRCA* genes?

*Answer:* Estrogen stimulates cells of the breast tissue to divide in preparation for milk production should a woman become pregnant. Thus, each month a woman experiences a surge in estrogen and thus a surge in cell division. If there is a mutation in those cells that makes uncontrolled division likely, such as a mutation in one of her *BRCA* genes, then her risk of developing cancer increases in this organ.

DQ: Why do people with “inherited” cancer often develop cancer at a relatively young age?

Type: Know It

Difficulty: Hard

Important Words/Concepts: *BRCA*, cancer risk, estrogen, mutation

137. Explain the effect of environmental mutagens in determining whether a woman with a mutation in one of her *BRCA* genes will actually get cancer.

*Answer:* Even if a woman has a mutation in one of her *BRCA* genes, she will not necessarily get cancer. Cancer usually only occurs when there is an accumulation of several mutations. Thus, environmental mutagens, such as smoking and exposure to pesticides, can cause these additional mutations and, together with the *BRCA* mutation, lead to cancer.

DQ: Why do people with “inherited” cancer often develop cancer at a relatively young age?

Type: Know It

Difficulty: Hard

Important Words/Concepts: *BRCA*, cancer risk, mutation

138. If you mother has a single copy of a harmful *BRCA* gene, what are the chances you inherited the harmful *BRCA* allele from her?

1. 0%
2. 25%
3. 50%
4. 75%
5. 100%

Answer: C

DQ: Why do people with “inherited” cancer often develop cancer at a relatively young age?

Type: Know It

Difficulty: Easy

Important Words/Concepts:*BRCA*, cancer risk, heredity

Refer to graph 10.8 to answer the next three questions:



139. What is the increased risk of breast cancer by age 70 if you have one copy of a deleterious *BRCA1* allele when compared with the general population?

1. 12%
2. 25%–42%
3. 44%–75%
4. 56%–87%
5. 87%

Answer: C

DQ: Why do people with “inherited” cancer often develop cancer at a relatively young age?

Type: Use It

Difficulty: Hard

Important Words/Concepts: *BRCA*, cancer risk, reading a graph

140. What is the increased risk of breast cancer by age 50 if you have one copy of a deleterious *BRCA1* allele when compared to the general population?

1. 2%
2. 31%–48%
3. 33%–50%
4. 56%–87%
5. 91%-100%

Answer: B

DQ: Why do people with “inherited” cancer often develop cancer at a relatively young age?

Type: Use It

Difficulty: Hard

Important Words/Concepts**:** *BRCA*, cancer risk, reading a graph

141. For those women with a mutation in their *BRCA* genes, the risk of developing breast cancer by age 50 is as high as \_\_\_\_\_\_\_\_\_, while in the general population the risk is \_\_\_\_\_\_\_\_\_.

1. 10%; <5%
2. 20%; <5%
3. 20%; 10%
4. 50%; <5%
5. 50%; 20%

Answer: D

DQ: Why do people with “inherited” cancer often develop cancer at a relatively young age?

Type: Use It

Difficulty: Easy

Important Words/Concepts:*BRCA*, cancer risk, reading a graph

142. Why is a person who has inherited one copy of a harmful *BRCA* allele much more likely to have early-onset breast cancer or ovarian cancer than a person with two functioning alleles?

1. Apoptosis is increased, as the tumor suppressors are not functioning.
2. Cell growth is accelerated, as oncogenes are switched on.
3. With the increase of BRCA protein, apoptosis is induced and cell death occurs.
4. Mutations accumulate as DNA repair is slowed and cell growth may accelerate.
5. Cells fail to enter apoptosis and eventually become a tumor.

Answer: D

DQ: Why do people with “inherited” cancer often develop cancer at a relatively young age?

Type: Use It

Difficulty: Easy

Important Words/Concepts: *BRCA*, cancer risk, DNA repair

143. Why does inheriting a mutation in a gene increase one’s risk of developing cancer?

1. It takes more than one mutation to develop cancer. People who inherit a mutation need fewer additional mutations to develop cancer.
2. It takes one mutation to develop cancer. People who inherit a mutation are already developing cancer as soon as they are born.
3. It takes one mutation in the right gene to develop cancer, so if they inherit a mutation in a key gene, then they will develop cancer.
4. Inheriting a mutation means we don’t need mutations from outside sources to develop cancer.
5. None of the above.

Answer: A

DQ: Why do people with “inherited” cancer often develop cancer at a relatively young age?

Type: Know It

Difficulty: Easy

Important Words/Concepts: DNA, mutation, inheritance, gene, cancer, predisposed

144. What kinds of preventative measures are available for individuals who have a strong genetic predisposition to breast cancer?

1. genetic counseling, so they know the risks
2. regular medical screening for cancer
3. a healthy lifestyle, a good diet, and an exercise regimen
4. prophylactic surgery
5. All of the above.

Answer: E

DQ: Why do people with “inherited” cancer often develop cancer at a relatively young age?

Type: Know It

Difficulty: Easy

Important Words/Concepts: breast cancer, predisposition, genetics, inheritance

145. Which of the following is MOST accurate?

1. Women with just one abnormal *BRCA* allele are less likely to develop skin cancer than women with no abnormal alleles.
2. Women with two abnormal *BRCA* alleles are less likely to develop skin cancer than women with no abnormal alleles.
3. Women with just one abnormal *BRCA* allele are more likely to develop cancer than women with no abnormal alleles.
4. Women with just one abnormal *BRCA* allele are more likely to develop ovarian cancer than women with two abnormal alleles.
5. Women with two abnormal *BRCA* alleles are less likely to develop breast cancer than women with no abnormal alleles.

Answer: C

**DQ:** Why do people with “inherited” cancer often develop cancer at a relatively young age?

Type: Know It

Difficulty: Easy

Important Words/Concepts:*BRCA* cancer

146. Women with mutations in their *BRCA* genes who have developed cancer may choose to have their breasts, ovaries, or both removed. Does this eliminate or just reduce the risk of cancer coming back? Explain your answer.

*Answer:* Removal of the breasts and/or ovaries will reduce, but not eliminate, the risk of cancer returning because there is breast tissue throughout the chest wall down to the abdomen and surgery cannot remove it all. In addition, women with mutations in their *BRCA* genes still have a higher than average risk of developing other forms of cancer.

DQ: Why do people with “inherited” cancer often develop cancer at a relatively young age?

Type: Know It

Difficulty: Hard

Important Words/Concepts:*BRCA*, mutation, surgery

147. For those women with a mutation in their *BRCA* genes, the risk of developing breast cancer by age 50 is as high as \_\_\_\_\_\_\_\_\_, while in the general population the risk is \_\_\_\_\_\_\_\_\_.

1. 10%; <5%
2. 20%; <5%
3. 20%; 10%
4. 50%; <5%
5. 50%; 20%

Answer: D

DQ: Why do people with “inherited” cancer often develop cancer at a relatively young age?

Type: Know It

Difficulty: Hard

Important Words/Concepts: *BRCA*, cancer risk

148. In addition to breast cancer, women with a mutation in one of their *BRCA* genes have an increased likelihood of developing which of the following other types of cancer?

1. liver
2. lung
3. ovarian
4. skin
5. bone

Answer: C

DQ: Why do people with “inherited” cancer often develop cancer at a relatively young age?

Type: Know It

Difficulty: Easy

Important Words/Concepts: *BRCA*, cancer risk

149. If a man inherits a mutation in one of his *BRCA* genes, is he at increased risk for cancer compared with men who inherit normal copies of *BRCA* genes? Is he at a lower or higher risk for cancer than a woman with the same mutation? Explain your answers.

*Answer:* A man who inherits a mutation in one of his *BRCA* genes is at an increased risk for cancer compared with men with normal *BRCA* genes, as he is more apt to develop breast, prostate, colon, or pancreatic cancer. However, his risk of cancer is not as high as a woman with the same mutation because women experience surges in estrogen that encourage cell division in the breast tissue and therefore increase the likelihood that a woman will develop cancer.

DQ: Why do people with “inherited” cancer often develop cancer at a relatively young age?

Type: Know It

Difficulty: Hard

Important Words/Concepts: *BRCA*, cancer risk