

### 3.B.C.D Formative

#### Multiple Choice

*Identify the letter of the choice that best completes the statement or answers the question.*

- \_\_\_\_\_ 1. In the yeast signal transduction pathway, after both types of mating cells have released the mating factors and the factors have bound to specific receptors on the correct cells,
- binding induces changes in the cells that lead to cell fusion.
  - the cells then produce the **a** factor and the  $\alpha$  factor.
  - one cell nucleus binds the mating factors and produces a new nucleus in the opposite cell.
  - the cell membranes fall apart, releasing the mating factors that lead to new yeast cells.
  - a growth factor is secreted that stimulates mitosis in both cells.
- \_\_\_\_\_ 2. Which of the following is *true* of the mating signal transduction pathway in yeast?
- The pathway carries an electrical signal between mating cell types.
  - Mating type **a** secretes a signal called **a** factor.
  - The molecular details of the pathway in yeast and in animals are very different.
  - Scientists think the pathway evolved long after multicellular creatures appeared on Earth.
  - The signal reception, transduction, and response occur in the nucleus.
- \_\_\_\_\_ 3. What could happen to the target cells in an animal that lack receptors for local regulators?
- They could compensate by receiving nutrients via an **a** factor.
  - They could develop normally in response to neurotransmitters instead.
  - They could divide but never reach full size.
  - They would not be able to multiply in response to growth factors from nearby cells.
  - Hormones would not be able to interact with target cells.
- \_\_\_\_\_ 4. Paracrine signaling
- involves secreting cells acting on nearby target cells by discharging a local regulator into the extracellular fluid.
  - requires nerve cells to release a neurotransmitter into the synapse.
  - occurs only in paracrine yeast cells.
  - has been found in plants but not animals.
  - involves mating factors attaching to target cells and causing production of new paracrine cells.
- \_\_\_\_\_ 5. Which of the following is *true* of synaptic signaling and hormonal signaling?
- Hormonal signaling occurs in animals only.
  - Hormonal signaling is important between cells that are at greater distances apart than in synaptic signaling.
  - Both act on target cells by a G-protein-signaling pathway.
  - Only A and B are true.
  - A, B, and C are true.
- \_\_\_\_\_ 6. When a cell releases a signal molecule into the environment and a number of cells in the immediate vicinity respond, this type of signaling is
- typical of hormones.
  - autocrine signaling.
  - paracrine signaling.
  - endocrine signaling.
  - synaptic signaling.

- \_\_\_\_\_ 7. A small molecule that specifically binds to another molecule, usually a larger one
- is called a signal transducer.
  - is called a ligand.
  - is called a polymer.
  - seldom is involved in hormonal signaling.
  - usually terminates a signal reception.
- \_\_\_\_\_ 8. Which of the following is (are) true of ligand-gated ion channels?
- They are important in the nervous system.
  - They lead to changes in sodium and calcium concentrations in cells.
  - They open or close in response to a chemical signal.
  - Only A and B are true.
  - A, B, and C are true.
- \_\_\_\_\_ 9. Which of the following signal systems use(s) G-protein-linked receptors?
- yeast mating factors
  - epinephrine
  - neurotransmitters
  - A and C only
  - A, B, and C
- \_\_\_\_\_ 10. What would be *true* for the signaling system in an animal cell that lacks the ability to produce GTP?
- It would not be able to activate and inactivate the G protein on the cytoplasmic side of the plasma membrane.
  - It could activate only the epinephrine system.
  - It would be able to carry out reception and transduction, but would not be able to respond to a signal.
  - Only A and C are true.
  - A, B, and C are true.
- \_\_\_\_\_ 11. G proteins and G-protein-linked receptors
- are found only in animal cells.
  - are found only in bacterial cells.
  - are thought to have evolved very early, because of their similar structure and function in a wide variety of modern organisms whose common ancestors diverged billions of years ago.
  - probably evolved from an adaptation of the citric acid cycle.
  - are not widespread in nature and were unimportant in the evolution of eukaryotes.
- \_\_\_\_\_ 12. The ability of a single ligand bound to a receptor protein to trigger several pathways is
- characteristic of the synaptic signal system.
  - unique to the yeast mating system.
  - rare in animals, but common in bacteria.
  - a key difference between the tyrosine-kinase and G-protein-linked receptor systems.
  - common to all plasma membrane receptor proteins.
- \_\_\_\_\_ 13. Membrane receptors that attach phosphates to specific amino acids in proteins are
- not found in humans.
  - called receptor tyrosine-kinases.
  - a class of GTP G-protein signal receptors.
  - associated with several bacterial diseases in humans.
  - important in yeast mating factors that contain amino acids.

- \_\_\_\_\_ 14. Up to 60% of all medicines used today exert their effects by influencing what structures in the cell membrane?
- tyrosine-kinases receptors
  - ligand-gated ion channel receptors
  - growth factors
  - G proteins
  - cholesterol
- \_\_\_\_\_ 15. The receptors for a group of signaling molecules known as growth factors are often
- ligand-gated ion channels.
  - G-protein-linked receptors.
  - cyclic AMP.
  - receptor tyrosine kinases.
  - neurotransmitters.
- \_\_\_\_\_ 16. Which of the following is (are) *true* regarding the activity of a protein regulated by phosphorylation?
- It depends mostly on the concentration of inorganic phosphate inside the cell.
  - It depends on the balance in the cell between active kinase and active phosphatase molecules.
  - It is dependent on the site of attachment of the protein to the plasma membrane.
  - Only A and B are true.
  - A, B, and C are true.
- \_\_\_\_\_ 17. Which of the following is widely used second messenger in signal transduction pathways?
- calcium ions
  - cyclic AMP
  - inositol trisphosphate
  - A and B only
  - A, B, and C
- \_\_\_\_\_ 18. Sutherland discovered that epinephrine
- signals bypass the plasma membrane of cells.
  - lowers blood glucose by binding to liver cells.
  - interacts with insulin inside muscle cells.
  - interacts directly with glycogen phosphorylase.
  - elevates the cytosolic concentration of cyclic AMP.
- \_\_\_\_\_ 19. Which of the following is *not* considered a second messenger?
- cAMP
  - GTP
  - calcium ions
  - diacylglycerol (DAG)
  - inositol trisphosphate (IP<sub>3</sub>)
- \_\_\_\_\_ 20. The general name for an enzyme that transfers phosphate groups from ATP to a protein is
- phosphorylase.
  - phosphatase.
  - protein kinase.
  - ATPase.
  - protease.



- \_\_\_\_\_ 21. Which of the following is *not* true of cell communication systems?
- Cell signaling was an early event in the evolution of life.
  - Communicating cells may be far apart or close together.
  - Most signal receptors are bound to the outer membrane of the nuclear envelope.
  - Protein phosphorylation is a major mechanism of signal transduction.
  - In response to a signal, the cell may alter activities by changes in cytosol activity or in transcription of RNA.
- \_\_\_\_\_ 22. Which of the following would be inhibited by a drug that specifically blocks the addition of phosphate groups to proteins?
- G-protein-linked receptor signaling
  - ligand-gated ion channel signaling
  - adenylyl cyclase activity
  - phosphatase activity
  - receptor tyrosine kinase activity
- \_\_\_\_\_ 23. An inhibitor of phosphodiesterase activity would have which of the following effects?
- block the response of epinephrine
  - decrease the amount of cAMP in the cytoplasm
  - block the activation of G proteins in response to epinephrine binding to its receptor
  - prolong the effect of epinephrine by maintaining elevated cAMP levels in the cytoplasm
  - block the activation of protein kinase A
- \_\_\_\_\_ 24. Adenylyl cyclase has the opposite effect of which of the following?
- protein kinase
  - protein phosphatase
  - phosphodiesterase
  - phosphorylase
  - GTPase
- \_\_\_\_\_ 25. Caffeine is an inhibitor of phosphodiesterase. Therefore, the cells of a person who has recently consumed coffee would have increased levels of
- phosphorylated proteins.
  - GTP.
  - cAMP.
  - adenylyl cyclase.
  - activated G proteins.
- \_\_\_\_\_ 26. If a pharmaceutical company wished to design a drug to maintain low blood sugar levels, one approach might be to
- design a compound that blocks epinephrine receptor activation.
  - design a compound that inhibits cAMP production in liver cells.
  - design a compound to block G-protein activity in liver cells.
  - design a compound that inhibits phosphorylase activity.
  - All of the above are possible approaches.
- \_\_\_\_\_ 27. If a pharmaceutical company wished to design a drug to maintain low blood sugar levels, one approach might be to
- design a compound that mimics epinephrine and can bind to the epinephrine receptor.
  - design a compound that stimulates cAMP production in liver cells.
  - design a compound to stimulate G protein activity in liver cells.
  - design a compound that increases phosphodiesterase activity.
  - All of the above are possible approaches.

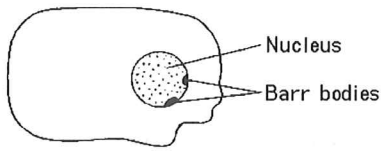


- \_\_\_\_\_ 28. Which of the following is an *incorrect* association?
- a. kinase activity and the addition of a phosphate group
  - b. phosphodiesterase activity and the removal of phosphate groups
  - c. GTPase activity and hydrolysis of GTP to GDP
  - d. phosphorylase activity and the catabolism of glycogen
  - e. adenylyl cyclase activity and the conversion of AMP to cAMP
- \_\_\_\_\_ 29. A drug designed to inhibit the response of cells to testosterone would almost certainly result in which of the following?
- a. lower cytoplasmic levels of cAMP
  - b. an increase in receptor tyrosine kinase activity
  - c. a decrease in transcriptional activity of certain genes
  - d. an increase in cytosolic calcium concentration
  - e. a decrease in G-protein activity
- \_\_\_\_\_ 30. If mammalian cells receive a go-ahead signal at the G<sub>1</sub> checkpoint, they will
- a. move directly into telophase.
  - b. complete the cycle and divide.
  - c. exit the cycle and switch to a nondividing state.
  - d. show a drop in MPF concentration.
  - e. complete cytokinesis and form new cell walls.
- \_\_\_\_\_ 31. Cells that are in a nondividing state are in which phase?
- a. G<sub>0</sub>
  - b. G<sub>2</sub>
  - c. G<sub>1</sub>
  - d. S
  - e. M
- \_\_\_\_\_ 32. Asexual reproduction and sexual reproduction are different in that
- a. individuals reproducing asexually transmit 100% of their genes to their progeny, whereas individuals reproducing sexually only transmit 50%.
  - b. asexual reproduction produces offspring that are genetically identical to the parents, whereas sexual reproduction gives rise to genetically distinct offspring.
  - c. asexual reproduction involves a single parent, whereas sexual reproduction involves two.
  - d. asexual reproduction only requires mitosis, whereas sexual reproduction always involves meiosis.
  - e. all of the above
- \_\_\_\_\_ 33. Which of the following happens at the conclusion of meiosis I?
- a. Homologous chromosomes are separated.
  - b. The chromosome number is conserved.
  - c. Sister chromatids are separated.
  - d. Four daughter cells are formed.
  - e. The sperm cells elongate to form a head and a tail end.
- \_\_\_\_\_ 34. Which of the following is *true of the process of meiosis*?
- a. Two diploid cells result.
  - b. Four diploid cells result.
  - c. Four haploid cells result.
  - d. Four autosomes result.
  - e. Four chiasmata result.

- \_\_\_\_\_ 35. Crossing over occurs during which phase of meiosis?
- prophase I
  - anaphase I
  - telophase I
  - prophase II
  - metaphase II
- \_\_\_\_\_ 36. Independent assortment of chromosomes is a result of
- the random and independent way in which each pair of homologous chromosomes lines up at the metaphase plate during meiosis I.
  - the random nature of the fertilization of ova by sperm.
  - the random distribution of the sister chromatids to the two daughter cells during anaphase II.
  - the relatively small degree of homology shared by the X and Y chromosomes.
  - all of the above
- \_\_\_\_\_ 37. The fact that all seven of the pea plant traits studied by Mendel obeyed the principle of independent assortment means that
- none of the traits obeyed the law of segregation.
  - the diploid number of chromosomes in the pea plants was 7.
  - all of the genes controlling the traits were located on the same chromosome.
  - all of the genes controlling the traits behaved as if they were on different chromosomes.
  - the formation of gametes in plants occurs by mitosis only.
- \_\_\_\_\_ 38. New combinations of linked genes are due to which of the following?
- nondisjunction
  - crossing over
  - independent assortment
  - mixing of sperm and egg
  - both A and C
- \_\_\_\_\_ 39. What is the mechanism for the production of genetic recombinants?
- X inactivation
  - methylation of cytosine
  - crossing over and independent assortment
  - nondisjunction
  - deletions and duplications during meiosis
- \_\_\_\_\_ 40. The frequency of crossing over between any two linked genes is
- higher if they are recessive.
  - different between males and females.
  - determined by their relative dominance.
  - the same as if they were not linked.
  - proportional to the distance between them.



- \_\_\_\_\_ 41. The figure below represents the stained nucleus from a cheek epithelial cell of an individual whose genotype would probably be



- a. XX.
  - b. XY.
  - c. XYY.
  - d. XXX.
  - e. XXY.
- \_\_\_\_\_ 42. If a pair of homologous chromosomes fails to separate during anaphase of meiosis I, what will be the chromosome number of the four resulting gametes with respect to the normal haploid number ( $n$ )?
- a.  $n + 1; n + 1; n - 1; n - 1$
  - b.  $n + 1; n - 1; n; n$
  - c.  $n + 1; n - 1; n - 1; n - 1$
  - d.  $n + 1; n + 1; n; n$
  - e.  $n - 1; n - 1; n; n$
- \_\_\_\_\_ 43. A cell that has  $2n + 1$  chromosomes is
- a. trisomic.
  - b. monosomic.
  - c. aneuploid.
  - d. polyploid.
  - e. both A and C
- \_\_\_\_\_ 44. One possible result of chromosomal breakage is for a fragment to join a nonhomologous chromosome. This is called a (an)
- a. deletion.
  - b. disjunction.
  - c. inversion.
  - d. translocation.
  - e. duplication.
- \_\_\_\_\_ 45. In the following list, which term is *least* related to the others?
- a. trisomic
  - b. monosomic
  - c. aneuploid
  - d. triploid
  - e. nondisjunction
- \_\_\_\_\_ 46. A nonreciprocal crossover causes which of the following products?
- a. deletion
  - b. duplication
  - c. nondisjunction
  - d. A and B
  - e. B and C

- \_\_\_\_\_ 47. One possible result of chromosomal breakage can be that a fragment reattaches to the original chromosome in a reverse orientation. This is called
- disjunction.
  - translocation.
  - deletion.
  - inversion.
  - aneuploidy.
- \_\_\_\_\_ 48. A human individual is phenotypically female, but her interphase somatic nuclei do not show the presence of Barr bodies. Which of the following statements concerning her is probably *true*?
- She has Klinefelter syndrome.
  - She has an extra X chromosome.
  - She has Turner syndrome.
  - She has the normal number of sex chromosomes.
  - She has two Y chromosomes.
- \_\_\_\_\_ 49. Of the following types of mutations, which one is likely to be the *most* common?
- point mutation
  - missense mutation
  - base-pair substitution
  - nonsense mutation
  - frameshift mutation
- \_\_\_\_\_ 50. What is the effect of a nonsense mutation in a gene?
- It changes an amino acid in the encoded protein.
  - It has no effect on the amino acid sequence of the encoded protein.
  - It introduces a stop codon into the mRNA.
  - It alters the reading frame of the mRNA.
  - It prevents introns from being expressed.

*Each of the following is a modification of the sentence THECATATETHERAT.*

- A. THERATATETHECAT  
B. THETACATETHERAT  
C. THECATARETHERAT  
D. THECATATTHERAT  
E. CATATETHERAT

- \_\_\_\_\_ 51. Which of the above is analogous to a frameshift mutation?
- A
  - B
  - C
  - D
  - E
- \_\_\_\_\_ 52. Which of the above is analogous to a single substitution mutation?
- A
  - B
  - C
  - D
  - E

- \_\_\_\_\_ 53. Sickle-cell disease is probably the result of which kind of mutation?
- point
  - frameshift
  - nonsense
  - nondisjunction
  - both B and D
- \_\_\_\_\_ 54. Which point mutation would be most likely to have a catastrophic effect on the functioning of a protein?
- a base substitution
  - a base deletion near the start of a gene
  - a base deletion near the end of the coding sequence, but not in the terminator codon
  - deletion of three bases near the start of the coding sequence, but not in the initiator codon
  - a base insertion near the end of the coding sequence, but not in the terminator codon
- \_\_\_\_\_ 55. Which of the following is a characteristic of all viruses?
- a nucleic acid genome
  - a protein capsid
  - a viral envelope
  - A and B only
  - A, B, and C
- \_\_\_\_\_ 56. Viral genomes can consist of any of the following *except*
- double-stranded DNA.
  - double-stranded RNA.
  - single-stranded DNA.
  - single-stranded RNA.
  - helical capsomeres.
- \_\_\_\_\_ 57. The host range of a virus is determined by
- the proteins on its surface.
  - whether its nucleic acid is DNA or RNA.
  - the proteins on the surface of the host cell.
  - the enzymes produced by the virus before it infects the cell.
  - both A and C
- \_\_\_\_\_ 58. Virulent phages undergo a(n) \_\_\_\_\_ life cycle, whereas temperate phages are capable of undergoing a(n) \_\_\_\_\_ cycle.
- infective; retroviral
  - lysogenic; lytic
  - lytic; lysogenic
  - retroviral; infective
  - infective; benign
- \_\_\_\_\_ 59. What is the function of the single-stranded RNA in certain animal viruses?
- It can serve directly as mRNA.
  - It can serve as a template for mRNA synthesis.
  - It can serve as a template for DNA synthesis.
  - Only A and C are correct.
  - A, B, and C are correct.

- \_\_\_\_\_ 60. Viruses with single-stranded RNA that acts as a template for DNA synthesis are known as
- retroviruses.
  - proviruses.
  - viroids.
  - bacteriophages.
  - lytic phages.
- \_\_\_\_\_ 61. The membrane making up the viral envelope can come from
- the virus itself, using enzymes encoded by the virus.
  - the nuclear membrane of an infected cell.
  - the plasma membrane of an infected cell.
  - both A and B
  - both B and C
- \_\_\_\_\_ 62. Viral envelopes contain proteins with covalently attached carbohydrate groups called
- glycoproteins.
  - proteosugars.
  - carbopeptides.
  - peptidocarbs.
  - carboproteins.
- \_\_\_\_\_ 63. Which of the following can be effective against viral diseases?
- vaccination
  - nucleoside analogs that inhibit DNA synthesis
  - antibiotics
  - A and B only
  - A, B, and C
- \_\_\_\_\_ 64. RNA viruses appear to have higher rates of mutation because
- RNA nucleotides are more unstable than DNA nucleotides.
  - replication of their genomes does not involve the proofreading steps of DNA replication.
  - RNA viruses replicate faster.
  - RNA viruses can incorporate a variety of nonstandard bases.
  - RNA viruses are more sensitive to mutagens.
- \_\_\_\_\_ 65. Which of the following contributes to the emergence of viral disease?
- production of new virus strains through mutation
  - spread of existing virus from one host species to another
  - transformation from lytic to lysogenic activity
  - A and B only
  - A, B, and C
- \_\_\_\_\_ 66. Reproduction in bacteria requires
- the production of a mitotic spindle.
  - a plasmid.
  - cyclic AMP.
  - replication of DNA.
  - both B and D

*Use the following answers for the following questions. The answers may be used once, more than once, or not at all.*

- A. transduction
- B. transposition
- C. translation
- D. transformation
- E. conjugation

- \_\_\_\_ 67. External DNA is assimilated by a cell.
- a. A
  - b. B
  - c. C
  - d. D
  - e. E
- \_\_\_\_ 68. DNA is transferred from one bacterium to another by a virus.
- a. A
  - b. B
  - c. C
  - d. D
  - e. E
- \_\_\_\_ 69. A group of  $F^+$  bacteria is mixed with a group of  $F^-$  bacteria. After several days, all of the bacteria are  $F^+$ .
- a. A
  - b. B
  - c. C
  - d. D
  - e. E
- \_\_\_\_ 70. A plasmid is exchanged between bacteria through a pilus.
- a. A
  - b. B
  - c. C
  - d. D
  - e. E
- \_\_\_\_ 71. A sequence of DNA is moved to alternative locations within the genome.
- a. A
  - b. B
  - c. C
  - d. D
  - e. E
- \_\_\_\_ 72. What does bacterial mating involve?
- a. exchange of egg and sperm
  - b. formation of a cytoplasmic bridge for the transfer of "male" DNA
  - c. sex pili that draw the cells together so that mRNA can be inserted
  - d. integration of male and female DNA into a cytoplasmic bridge
  - e. binary fission of a bacterial cell

- \_\_\_\_\_ 73. Which of the following statements regarding transposons is *not* true?
- Transposons are genes that encode sex pili and enable plasmid transfers between bacteria.
  - Transposons are found in both prokaryotes and eukaryotes.
  - Transposons can move from a plasmid to the bacterial circular chromosome.
  - Transposons may replicate at an original site and insert a copy at another site.
  - Transposons may carry only the genes necessary for insertion.
- \_\_\_\_\_ 74. An R plasmid can
- facilitate bacterial resistance to antibiotics.
  - adjust the rates of metabolic pathways.
  - repress gene expression.
  - convert an F<sup>+</sup> to an F<sup>-</sup> bacterium.
  - reverse the direction of transcription.
- \_\_\_\_\_ 75. The role of a metabolite that controls a repressible operon is to
- bind to the promoter region and decrease the affinity of RNA polymerase for the promoter.
  - bind to the operator region and block the attachment of RNA polymerase to the promoter.
  - increase the production of inactive repressor proteins.
  - bind to the repressor protein and inactivate it.
  - bind to the repressor protein and activate it.
- \_\_\_\_\_ 76. The tryptophan operon is a repressible operon that is
- permanently turned on.
  - turned on only when tryptophan is present in the growth medium.
  - turned off only when glucose is present in the growth medium.
  - turned on only when glucose is present in the growth medium.
  - turned off whenever tryptophan is added to the growth medium.

*For the following questions, match the terms below with the appropriate phrase or description below. Each term can be used once, more than once, or not at all.*

- A. operon
- B. inducer
- C. promoter
- D. repressor
- E. corepressor

- \_\_\_\_\_ 77. This protein is produced by a regulatory gene.
- A
  - B
  - C
  - D
  - E

- \_\_\_\_\_ 78. A mutation in this section of DNA could influence the binding of RNA polymerase to the DNA.
- A
  - B
  - C
  - D
  - E
- \_\_\_\_\_ 79. A lack of this nonprotein molecule would result in the inability of the cell to "turn off" genes.
- A
  - B
  - C
  - D
  - E
- \_\_\_\_\_ 80. Which of the following statements about operons is (are) *true*?
- The tryptophan operon is a repressible operon.
  - Tryptophan itself can bind to the *trp* operator and shut down production of tryptophan pathway enzymes.
  - The lactose operon repressor binds to the operator and turns on the synthesis of the enzyme  $\beta$ -galactosidase.
  - Only A and C are correct.
  - A, B, and C are correct.
- \_\_\_\_\_ 81. How does active CAP induce expression of the genes of the lactose operon?
- It terminates production of repressor molecules.
  - It degrades the substrate allolactose.
  - It stimulates splicing of the encoded genes.
  - It stimulates the binding of RNA polymerase to the promoter.
  - It binds steroid hormones and controls translation.
- \_\_\_\_\_ 82. For a repressible operon to be transcribed, which of the following must be *true*?
- A corepressor must be present.
  - RNA polymerase and the active repressor must be present.
  - RNA polymerase must bind to the promoter, and the repressor must be inactive.
  - RNA polymerase cannot be present, and the repressor must be inactive.
  - RNA polymerase must not occupy the promoter, and the repressor must be inactive.
- \_\_\_\_\_ 83. Allolactose induces the synthesis of the enzyme lactase. An *E. coli* cell is presented for the first time with the sugar lactose (containing allolactose) as a potential food source. Which of the following occurs when the lactose enters the cell?
- The repressor protein attaches to the regulator.
  - Allolactose binds to the repressor protein.
  - Allolactose binds to the regulator.
  - The repressor protein and allolactose bind to RNA polymerase.
  - RNA polymerase attaches to the regulator.
- \_\_\_\_\_ 84. Of the following, which is *least* related to the others?
- corepressor
  - repressor
  - inducer
  - transposon
  - cAMP receptor protein





- \_\_\_\_\_ 85. In a nucleosome, what is the DNA wrapped around?
- polymerase molecules
  - ribosomes
  - mRNA
  - histones
  - nucleolus protein
- \_\_\_\_\_ 86. If a cell were unable to produce histone proteins, which of the following would be expected to occur?
- There would be an increase in the amount of "satellite" DNA produced during centrifugation.
  - The cell's DNA couldn't be packed into its nucleus.
  - Spindle fibers would not form during prophase.
  - Amplification of other genes would compensate for the lack of histones.
  - Pseudogenes would be transcribed to compensate for the decreased protein in the cell.
- \_\_\_\_\_ 87. Why do histones bind tightly to DNA?
- Histones are positively charged, and DNA is negatively charged.
  - Histones are negatively charged, and DNA is positively charged.
  - Both histones and DNA are strongly hydrophobic.
  - Histones are covalently linked to the DNA.
  - Histones are highly hydrophobic, and DNA is hydrophilic.
- \_\_\_\_\_ 88. Which of the following mechanisms is (are) used to coordinately control the expression of multiple, related genes in eukaryotic cells?
- organization of the genes into clusters, with local chromatin structures influencing the expression of all the genes at once
  - each of the genes sharing a common control element, allowing a single activator to turn on their transcription at once, regardless of their location in the genome
  - organizing the genes into large operons, allowing them to be transcribed as a single unit
  - A and B only
  - A, B, and C
- \_\_\_\_\_ 89. If you were to observe the activity of methylated DNA, you would expect it to
- be replicating.
  - be unwinding in preparation for protein synthesis.
  - have turned off or slowed down the process of transcription.
  - be very active in translation.
  - induce protein synthesis by not allowing repressors to bind to it.
- \_\_\_\_\_ 90. Two potential devices that eukaryotic cells use to regulate transcription are DNA \_\_\_\_\_ and histone \_\_\_\_\_.
- methylation; amplification
  - amplification; methylation
  - acetylation; methylation
  - methylation; acetylation
  - amplification; acetylation
- \_\_\_\_\_ 91. In eukaryotes, transcription is generally associated with
- euchromatin only.
  - heterochromatin only.
  - very tightly packed DNA only.
  - highly methylated DNA only.
  - both euchromatin and histone acetylation.



- \_\_\_\_\_ 92. A significant difference between eukaryotes and prokaryotes is that
- DNA is wound around proteins to form chromatin in eukaryotes, but in prokaryotes the DNA is not associated with proteins.
  - gene expression is largely regulated by transcription in prokaryotes, but not in eukaryotes.
  - prokaryotic genes do not contain introns.
  - noncoding DNA sequences are found in prokaryotes, but not in eukaryotes.
  - prokaryotes have less DNA but more noncoding segments than eukaryotes.
- \_\_\_\_\_ 93. General transcription factors
- are required for the expression of all protein-encoding genes.
  - bind to other proteins or to a sequence element within the promoter called the TATA box.
  - help RNA polymerase bind to the promoter and begin transcribing.
  - usually only lead to a low level of transcription in the absence of additional proteins called *specific* transcription factors.
  - all of the above

*Use the terms below to answer the following questions. Each term may be used once, more than once, or not at all.*

- A. enhancer
- B. promoter
- C. activator
- D. repressor
- E. terminator

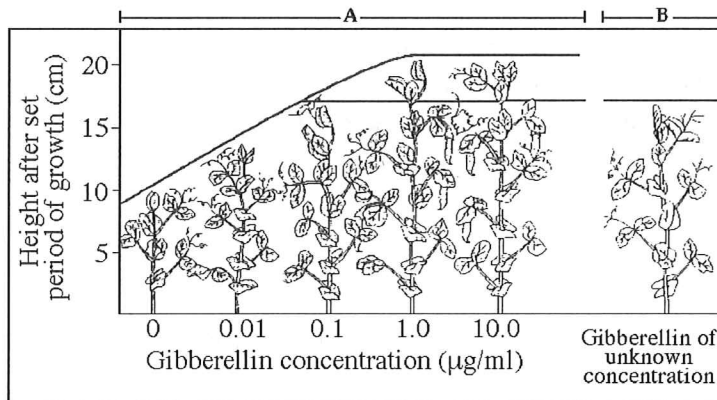
- \_\_\_\_\_ 94. binds to a site in the DNA far from the promoter to stimulate transcription
- A
  - B
  - C
  - D
  - E
- \_\_\_\_\_ 95. can inhibit transcription by blocking the binding of positively acting transcription factors to the DNA
- A
  - B
  - C
  - D
  - E
- \_\_\_\_\_ 96. site in the DNA located near the end of the final exon, encoding an RNA sequence that determines the 3' end of the transcript
- A
  - B
  - C
  - D
  - E

- \_\_\_\_ 97. Which of the following statements concerning proto-oncogenes is *false*?
- They can code for proteins associated with cell growth.
  - They are similar to oncogenes found in retroviruses.
  - They are produced by somatic mutations induced by carcinogenic substances.
  - They can be involved in producing proteins for cell adhesion.
  - They can code for proteins involved in cell division.
- \_\_\_\_ 98. Which of the following events is (are) necessary for the production of a malignant tumor?
- activation of an oncogene in the cell
  - inactivation of tumor-suppressor genes within the cell
  - presence of mutagenic substances within the cell's environment
  - presence of a retrovirus within the cell
  - both A and B
- \_\_\_\_ 99. The Ras protein is involved in \_\_\_\_\_, and cancer-causing forms of the protein are usually \_\_\_\_\_.
- relaying a signal from a growth factor receptor; hyperactive
  - DNA replication; nonfunctional
  - DNA repair; hyperactive
  - cell-cell adhesion; nonfunctional
  - cell division; nonfunctional
- \_\_\_\_ 100. A genetic test to detect predisposition to cancer would likely examine the *APC* gene for \_\_\_\_\_ cancer and the *BRCA1* and *BRCA2* genes for \_\_\_\_\_ cancer.
- colorectal; breast
  - lung; breast
  - breast; lung
  - colorectal; lung
  - lung; prostate
- \_\_\_\_ 101. Which of the following can contribute to the development of cancer?
- random spontaneous mutations
  - mutations caused by X-rays
  - transposition
  - A and B only
  - A, B, and C
- \_\_\_\_ 102. Which of the following is (are) involved in embryonic development?
- cell division
  - cell differentiation
  - morphogenesis
  - A and B only
  - A, B, and C
- \_\_\_\_ 103. The gene for which protein would most likely be expressed as a result of MyoD activity?
- myosin
  - crystallin
  - albumin
  - hemoglobin
  - DNA polymerase

- \_\_\_\_\_ 104. The general process that leads to the differentiation of cells is called
- determination.
  - specialization.
  - identification.
  - differentialization.
  - cellularization.
- \_\_\_\_\_ 105. Which of the following involves apoptosis?
- Interactions between muscle cells and bone cells guide the growth of the muscle to a specific location so that it can attach to the bone.
  - Cells from the top of the mouth combine with cells from the base of the brain to form the pituitary.
  - A gonad begins as an undifferentiated organ that can form either an ovary or a testis. The formation depends on the hormonal signals that control the growth of some cells and the death of others.
  - If part of the developing spinal cord in a frog embryo is transplanted to under the skin of its back, it will stimulate development of an eye in that location.
  - The bones of the spinal column develop from blocks of undifferentiated tissue called somites.
- \_\_\_\_\_ 106. In vertebrates, programmed cell death is essential for all of the following *except*
- normal development of the nervous system.
  - normal operation of the immune system.
  - normal morphogenesis of human feet.
  - normal removal of damaged cells.
  - normal triggering of the signal transduction pathways.
- \_\_\_\_\_ 107. Which statement about natural selection is *most* correct?
- Adaptations beneficial in one habitat should generally be beneficial in all other habitats as well.
  - Different species that together occupy the same habitat will adapt to that habitat by undergoing the same genetic changes.
  - Adaptations beneficial at one time should generally be beneficial during all other times as well.
  - Well-adapted individuals leave more offspring, and thus contribute more to the gene pool, than poorly adapted individuals.
  - Natural selection is the sole means by which populations can evolve.
- \_\_\_\_\_ 108. Given a population that contains genetic variation, what is the correct sequence of the following events, under the influence of natural selection?
- Differential reproduction occurs.
  - A new selective pressure arises.
  - Allele frequencies within the population change.
  - Poorly adapted individuals have decreased survivorship.
- 2, 4, 1, 3
  - 4, 2, 1, 3
  - 4, 1, 2, 3
  - 4, 2, 3, 1
  - 2, 4, 3, 1

- \_\_\_\_ 109. Which of the following statements is *not* an inference of natural selection?
- Subsequent generations of a population should have greater proportions of individuals that possess favorable traits.
  - An individual organism undergoes evolution over the course of its lifetime.
  - Often only a fraction of offspring survive, because there is a struggle for limited resources.
  - Individuals whose inherited characteristics best fit them to the environment should leave more offspring.
  - Unequal reproductive success among its members leads a population to adapt over time.
- \_\_\_\_ 110. Which of the following *must* exist in a population before natural selection can act upon that population?
- genetic variation among individuals
  - variation among individuals caused by environmental factors
  - sexual reproduction
  - A and C only
  - A, B, and C
- \_\_\_\_ 111. The step(s) between a plant's perception of a change in the environment and the plant's response to that change is (are) best called
- a mutation.
  - hormone production.
  - pH change.
  - signal transduction.
  - an "all-or-none" response.
- \_\_\_\_ 112. All of the following may function in signal transduction in plants *except*
- calcium ions.
  - nonrandom mutations.
  - receptor proteins.
  - phytochrome.
  - second messengers.
- \_\_\_\_ 113. External stimuli would be received most quickly by a plant cell if the receptors for signal transduction were located in the
- cell membrane.
  - cytoplasmic matrix.
  - endoplasmic reticulum.
  - nuclear membrane.
  - nucleoplasm.
- \_\_\_\_ 114. Secondary messengers are associated with which of the following?
- reception
  - transduction
  - response
  - both A and B
  - both B and C
- \_\_\_\_ 115. Why might animal hormones function differently from plant hormones?
- Animals move rapidly away from negative stimuli, and most plants don't.
  - Plant cells have a cell wall that blocks passage of many hormones.
  - Plants must have more precise timing of their reproductive activities.
  - Plants are much more variable in their morphology and development than animals.
  - Both A and D are correct.

Refer to the figure below to answer the following questions.



- \_\_\_\_ 116. The results of this experiment, shown on the left of the graph (area A), may be used to
- show that these plants can live without gibberellin.
  - show that gibberellin is necessary in positive gravitropism.
  - show that taller plants with more gibberellin produce fruit (pods).
  - show a correlation between plant height and gibberellin concentration.
  - study phytoalexins in plants.
- \_\_\_\_ 117. In order for a plant to initiate chemical responses to herbivory,
- the plant must be directly attacked by an herbivore.
  - volatile "signal" compounds must be perceived.
  - gene-for-gene recognition must occur.
  - phytoalexins must be released.
  - all of the above must happen.
- \_\_\_\_ 118. Plants are affected by an array of pathogens. Which of the following is *not* a plant defense against disease?
- cells near the point of infection destroying themselves to prevent the spread of the infection
  - production of chemicals that kill pathogens
  - acquiring gene-for-gene recognition that allows specific proteins to interact so that the plant can produce defenses against the pathogen
  - a waxy cuticle that pathogens have trouble penetrating
  - All of the above are plant defenses against disease.
- \_\_\_\_ 119. Which of the following are defenses that some plants use against herbivory?
- production of the unusual amino acid canavanine
  - release of volatile compounds that attract parasitoid wasps
  - association of plant tissues with mycorrhizae
  - A and B only
  - A, B, and C
- \_\_\_\_ 120. The transduction pathway that activates systemic acquired resistance in plants is initially signaled by
- antisense RNA.
  - $P_{fr}$  phytochrome.
  - salicylic acid.
  - abscisic acid.
  - red, but not far-red, light.

- \_\_\_\_\_ 121. Which of the following statements about hormones is *incorrect*?
- They are produced by endocrine glands.
  - They are modified amino acids, peptides, or steroid molecules.
  - They are carried by the circulatory system.
  - They are used to communicate between different organisms.
  - They elicit specific biological responses from target cells.
- \_\_\_\_\_ 122. Where is it likely that you will find the receptor molecules for chemical signals?
- in the nucleus of target cells
  - in the interstitial fluid surrounding target cells
  - in the cytoplasm of target cells
  - in the cell membrane of target cells
  - associated with the DNA of target cells
- \_\_\_\_\_ 123. Blood samples taken from an individual who had been fasting for 24 hours would have which of the following?
- high levels of insulin
  - high levels of glucagon
  - low levels of insulin
  - low levels of glucagon
  - both B and C
- \_\_\_\_\_ 124. Where do synaptic vesicles discharge their contents by exocytosis?
- dendrite
  - axon hillock
  - nodes of Ranvier
  - postsynaptic membrane
  - presynaptic membrane
- \_\_\_\_\_ 125. Neurotransmitters are released from presynaptic axon terminals into the synaptic cleft by which mechanism?
- osmosis
  - active transport
  - diffusion
  - endocytosis
  - exocytosis
- \_\_\_\_\_ 126. Which of the following offers the best description of neural transmission across a mammalian synaptic gap?
- Neural impulses involve the flow of  $K^+$  and  $Na^+$  across the gap.
  - Neural impulses travel across the gap as electrical currents.
  - Neural impulses cause the release of chemicals that diffuse across the gap.
  - Neural impulses travel across the gap in both directions.
  - The calcium within the axons and dendrites of nerves adjacent to a synapse acts as the neurotransmitter.



**3.B.C.D Formative  
Answer Section****MULTIPLE CHOICE**

- |            |                   |
|------------|-------------------|
| 1. ANS: A  | TOP: Concept 11.1 |
| 2. ANS: B  | TOP: Concept 11.1 |
| 3. ANS: D  | TOP: Concept 11.1 |
| 4. ANS: A  | TOP: Concept 11.1 |
| 5. ANS: B  | TOP: Concept 11.1 |
| 6. ANS: C  | TOP: Concept 11.1 |
| 7. ANS: B  | TOP: Concept 11.2 |
| 8. ANS: E  | TOP: Concept 11.2 |
| 9. ANS: E  | TOP: Concept 11.2 |
| 10. ANS: A | TOP: Concept 11.2 |
| 11. ANS: C | TOP: Concept 11.2 |
| 12. ANS: D | TOP: Concept 11.2 |
| 13. ANS: B | TOP: Concept 11.2 |
| 14. ANS: D | TOP: Concept 11.2 |
| 15. ANS: D | TOP: Concept 11.3 |
| 16. ANS: B | TOP: Concept 11.3 |
| 17. ANS: E | TOP: Concept 11.3 |
| 18. ANS: E | TOP: Concept 11.3 |
| 19. ANS: B | TOP: Concept 11.3 |
| 20. ANS: C | TOP: Concept 11.3 |
| 21. ANS: C | TOP: Concept 11.3 |
| 22. ANS: E | TOP: Concept 11.3 |
| 23. ANS: D | TOP: Concept 11.3 |
| 24. ANS: C | TOP: Concept 11.3 |
| 25. ANS: C | TOP: Concept 11.3 |
| 26. ANS: E | TOP: Concept 11.3 |
| 27. ANS: D | TOP: Concept 11.3 |
| 28. ANS: B | TOP: Concept 11.3 |
| 29. ANS: C | TOP: Concept 11.4 |
| 30. ANS: B | TOP: Concept 12.3 |
| 31. ANS: A | TOP: Concept 12.3 |
| 32. ANS: E | TOP: Concept 13.1 |
| 33. ANS: A | TOP: Concept 13.3 |
| 34. ANS: C | TOP: Concept 13.3 |
| 35. ANS: A | TOP: Concept 13.3 |
| 36. ANS: A | TOP: Concept 13.4 |
| 37. ANS: D | TOP: Concept 14.1 |
| 38. ANS: B | TOP: Concept 15.2 |
| 39. ANS: C | TOP: Concept 15.2 |

40. ANS: E	TOP: Concept 15.2
41. ANS: D	TOP: Concept 15.4
42. ANS: A	TOP: Concept 15.4
43. ANS: E	TOP: Concept 15.4
44. ANS: D	TOP: Concept 15.4
45. ANS: D	TOP: Concept 15.4
46. ANS: D	TOP: Concept 15.4
47. ANS: D	TOP: Concept 15.4
48. ANS: C	TOP: Concept 15.4
49. ANS: A	TOP: Concept 17.7
50. ANS: C	TOP: Concept 17.7
51. ANS: D	TOP: Concept 17.7
52. ANS: C	TOP: Concept 17.7
53. ANS: A	TOP: Concept 17.7
54. ANS: B	TOP: Concept 17.7
55. ANS: D	TOP: Concept 18.1
56. ANS: E	TOP: Concept 18.1
57. ANS: E	TOP: Concept 18.1
58. ANS: C	TOP: Concept 18.1
59. ANS: E	TOP: Concept 18.1
60. ANS: A	TOP: Concept 18.1
61. ANS: E	TOP: Concept 18.1
62. ANS: A	TOP: Concept 18.1
63. ANS: D	TOP: Concept 18.2
64. ANS: B	TOP: Concept 18.2
65. ANS: D	TOP: Concept 18.2
66. ANS: D	TOP: Concept 18.3
67. ANS: D	TOP: Concept 18.3
68. ANS: A	TOP: Concept 18.3
69. ANS: E	TOP: Concept 18.3
70. ANS: E	TOP: Concept 18.3
71. ANS: B	TOP: Concept 18.3
72. ANS: B	TOP: Concept 18.3
73. ANS: A	TOP: Concept 18.3
74. ANS: A	TOP: Concept 18.3
75. ANS: E	TOP: Concept 18.4
76. ANS: E	TOP: Concept 18.4
77. ANS: D	TOP: Concept 18.4
78. ANS: C	TOP: Concept 18.4
79. ANS: E	TOP: Concept 18.4
80. ANS: A	TOP: Concept 18.4
81. ANS: D	TOP: Concept 18.4
82. ANS: C	TOP: Concept 18.4
83. ANS: B	TOP: Concept 18.4

84. ANS: D	TOP: Concept 18.4
85. ANS: D	TOP: Concept 19.1
86. ANS: B	TOP: Concept 19.1
87. ANS: A	TOP: Concept 19.1
88. ANS: D	TOP: Concept 19.2
89. ANS: C	TOP: Concept 19.2
90. ANS: D	TOP: Concept 19.2
91. ANS: E	TOP: Concept 19.2
92. ANS: C	TOP: Concept 19.2
93. ANS: E	TOP: Concept 19.2
94. ANS: C	TOP: Concept 19.2
95. ANS: D	TOP: Concept 19.2
96. ANS: E	TOP: Concept 19.2
97. ANS: C	TOP: Concept 19.3
98. ANS: E	TOP: Concept 19.3
99. ANS: A	TOP: Concept 19.3
100. ANS: A	TOP: Concept 19.3
101. ANS: E	TOP: Concept 19.3
102. ANS: E	TOP: Concept 21.1
103. ANS: A	TOP: Concept 21.2
104. ANS: A	TOP: Concept 21.2
105. ANS: C	TOP: Concept 21.3
106. ANS: E	TOP: Concept 21.3
107. ANS: D	TOP: Concept 22.2
108. ANS: A	TOP: Concept 22.2
109. ANS: B	TOP: Concept 22.2
110. ANS: D	TOP: Concept 22.2
111. ANS: D	TOP: Concept 39.1
112. ANS: B	TOP: Concept 39.1
113. ANS: A	TOP: Concept 39.1
114. ANS: B	TOP: Concept 39.1
115. ANS: E	TOP: Concept 39.2
116. ANS: D	TOP: Concept 39.2
117. ANS: B	TOP: Concept 39.5
118. ANS: E	TOP: Concept 39.5
119. ANS: D	TOP: Concept 39.5
120. ANS: C	TOP: Concept 39.5
121. ANS: D	TOP: Concept 45.1, Concept 45.4
122. ANS: D	TOP: Concept 45.2
123. ANS: E	TOP: Concept 45.4
124. ANS: E	TOP: Concept 48.4
125. ANS: E	TOP: Concept 48.4
126. ANS: C	TOP: Concept 48.4

