

- 1) What is the most likely role of a cell that contains an extensive smooth ER?
A) It plays a role in storage. B) It synthesizes large quantities of lipids.
C) It actively exports protein molecules. D) It plays a role in immune function.
- 2) The small intestine is the site of digestion and absorption of nutrients. A single layer of epithelial cells lines the small intestine. In the duodenum (the first section of the small intestine), these epithelial cells secrete large quantities of digestive enzymes. Which of the following features would be typical of these epithelial cells?
A) They contain large numbers of lysosomes.
B) They have more smooth endoplasmic reticulum than rough endoplasmic reticulum.
C) They contain large quantities of rough endoplasmic reticulum.
D) They have larger nuclei than cells that secrete large quantities of lipids.
- 3) Which of the following is *not* a characteristic that chloroplasts and mitochondria share?
A) They both have their own DNA. B) They are both double-membrane structures.
C) They are both part of the endomembrane system. D) They are capable of reproducing themselves.
- 4) Mitochondrial DNA codes for about 13 proteins (depending on the species of organism). These 13 proteins account for a small proportion of the proteins present in mitochondria. The remaining proteins are coded for by nuclear DNA. What is the most likely explanation for how these proteins find their way to the mitochondria?
A) signal sequences
B) random transport vesicles
C) attachment of ribosomes to outer mitochondrial pores and direct deposition into the inner mitochondrial compartment
D) mRNAs that are manufactured in the nucleus, but translated by mitochondrial ribosomes
- 5) Asbestos is a material that was once used extensively in construction. One of the risks of working in a building that contains asbestos is the development of asbestosis. The asbestos fibers can be inhaled. Cells will phagocytose the foreign material, but are unable to degrade it. As a result, asbestos fibers build up in which of the following intracellular organelles?
A) mitochondria B) nucleus C) peroxisomes D) lysosomes
- 6) Which of the following is *not found in a prokaryotic cell*?
A) DNA
B) cell wall
C) plasma membrane
D) ribosomes
E) endoplasmic reticulum
- 7) In animal cells, hydrolytic enzymes are packaged to prevent general destruction of cellular components. Which of the following organelles functions in this compartmentalization?
A) chloroplast
B) lysosome
C) central vacuole
D) peroxisome
E) glyoxysome

For the following questions, use the lettered answers to match the structure to its proper cell type. Choose the most inclusive category. Each answer may be used once, more than once, or not at all.

- A. a feature of all cells
- B. found in prokaryotic cells only
- C. found in eukaryotic cells only
- D. found in plant cells only
- E. found in animal cells only

8) plasma membrane

9) nucleoid

10) mitochondria

11) Once a cell completes mitosis, the triggers to enter must be turned off. What happens to MPF during mitosis?

- A) It is completely degraded.
- B) The cyclin-dependent kinases take on a function unrelated to mitosis.
- C) Cyclin is degraded; the concentration of cyclin-dependent kinase remains unchanged, but without cyclin, MPF is not formed.
- D) Cyclin-dependent kinase is degraded; cyclin concentration remains constant, but without cyclin-dependent kinase, MPF is not formed.

12) Which of the following is *not* an effect of mitosis-promoting factor (MPF) involved in moving a cell into M phase?

- A) phosphorylation of lamins, initiating breakdown of the nuclear membrane
- B) phosphorylation of microtubule associated proteins, triggering the formation of the mitotic spindle
- C) phosphorylation of an enzyme that breaks down the cyclin molecule
- D) degradation of cyclin-dependent kinase

13) When scientists fused two cells in different stages of the cell cycle (e.g., interphase and prophase), they found the interphase nucleus entered the M phase of the cell cycle. How did they interpret these results?

- A) The events of mitosis predominate over interphase.
- B) Some chemical signaling molecule must be present that promotes entry of the cell into the M phase.
- C) The chromosomes from the two nuclei share histones.
- D) The cell that was in interphase must have been in G₁ and ready to enter mitosis.

14) What major events occur during anaphase of mitosis?

- A) Chromosomes replicate, so each chromosome consists of two identical sister chromatids.
- B) Chromosomes condense and the nuclear envelope disappears.
- C) The chromosomes end up at opposite ends of the cell, and two nuclear envelopes form.
- D) Sister chromatids separate, forming independent chromosomes.

15) According to the data in **Figure 11.4**, the first labeled mitotic cells appear about 4 hours after the labeling period ends.

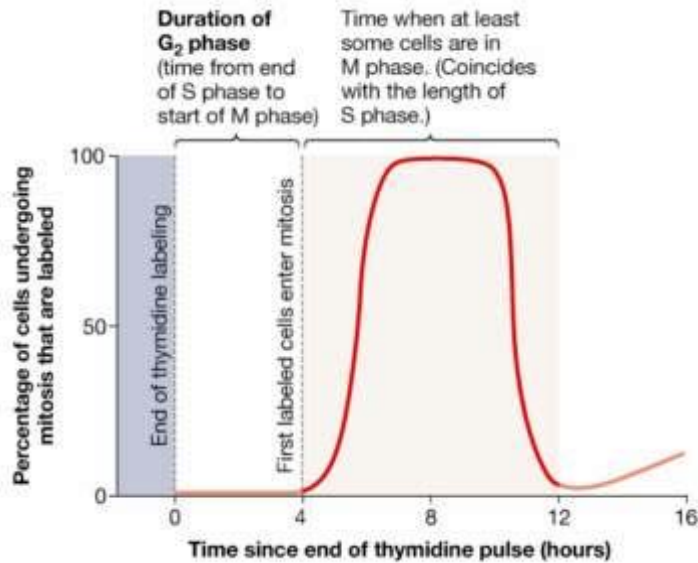


Figure 11.4

From these data, researchers concluded that G_2 lasted about 4 hours. Why?

- A) The lengths of the total cell cycle and the G_1 , S, and M phases were known, so the length of G_2 could be found by subtraction.
- B) It confirmed other data indicating that G_2 lasts about 4 hours in cultured cells of this type.
- C) Cyclins were labeled, so their concentration had to build up for 4 hours.
- D) Labeled cells are in S phase, so 4 hours passed between the end of S phase and the onset of M phase.

16) What evidence suggests that during anaphase, spindle fibers shorten at the kinetochore and not at the base of the mitotic spindle?

- A) Motor proteins are located at the kinetochore.
- B) Motor proteins are located at the kinetochore and at the base of the mitotic spindle.
- C) When fluorescing microtubules are bleached in the middle, the bleached segment stays stationary as the fibers shorten.
- D) When fluorescing microtubules are bleached in the middle, the bleached segment moves toward the base of the mitotic spindle as the fibers shorten.

17) If cells in the process of dividing are subjected to colchicine, a drug that inhibits polymerization of tubulin, what result could you predict?

- A) the cell would not be able to complete cytokinesis
- B) the mitotic spindle would not form
- C) the nuclear membrane would remain intact
- D) the kinetochore would break down
- E) the daughter nuclei would have too many chromosomes

18) A group of cells is assayed for DNA content immediately following mitosis and is found to have an average of 8 picograms of DNA per nucleus. Those cells would have _____ picograms at the end of the S phase and _____ picograms at the end of G_2 .

- A) 8 ... 8 B) 8 ... 16 C) 16 ... 8 D) 16 ... 16 E) 12 ... 16

- 19) During which phase(s) of mitosis do we find chromosomes composed of two chromatids?
- from interphase through anaphase
 - from G₁ of interphase through metaphase
 - from metaphase through telophase
 - from anaphase through telophase
 - from G₂ of interphase through metaphase

The following questions are based on Figure 12.3.

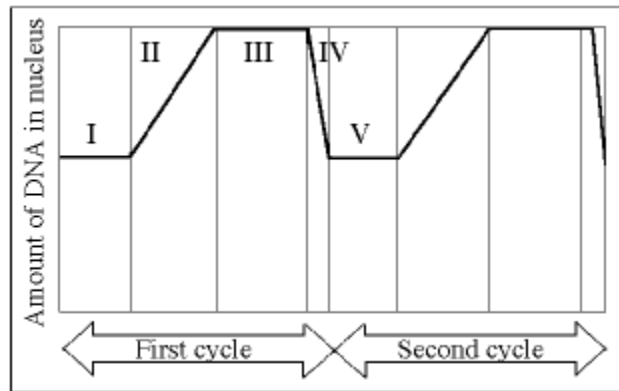


Figure 12.3

- 20) Which number represents G₁?
- I and V
 - II and IV
 - III
 - IV
 - V
- 21) Which number represents DNA synthesis?
- I
 - II
 - III
 - IV
 - V
- 22) MPF reaches its threshold concentration at the end of this stage.
- I
 - II
 - III
 - IV
 - V
- 23) A bacterial culture is grown on medium containing radioactive thymine (represented by T[#]) until all of the thymine in the DNA is radioactive. The culture is then transferred to a medium containing nonradioactive thymine (T). Samples are removed after one round of DNA replication. Which of the following double-stranded sequences represents a sequence of DNA after one round of replication? (Note that A, T, C, and G represent the nucleotides with the four standard bases. The slash [/] separates the two strands of the double helix.)
- AT[#]CG / TAGC
 - CTAG / CT[#]AG
 - AT[#]TT / CAA[#]A
 - GAT[#]A / CUAU
 - AT[#]TT / AT[#]TT
- 24) If the GC content of a double-stranded DNA molecule is 60%, what are the molar percentages of the four bases (G, C, T, A)?
- G = 30%; C = 30%; A = 20%; T = 20%
 - G = 20%; C = 20%; A = 30%; T = 30%
 - G = 10%; C = 50%; A = 20%; T = 20%
 - G = 0%; C = 60%; A = 0%; T = 40%
 - There is not enough information to answer this question.

25) In the late 1950s Herbert Taylor and co-workers grew bean root-tip cells in a solution of radioactive _____ to specifically label the DNA and allowed the cells sufficient time to undergo one round of DNA replication. For the purposes of this question, assume that he saw each labeled metaphase chromosome with the following configuration (labeled chromosomal material is dark; unlabeled chromosomal material is light). What would be his conclusion as to the replication of DNA?



- A) uracil; conservative
- B) uracil; semiconservative
- C) thymidine; dispersive
- D) thymidine; semiconservative
- E) thymidine; conservative

26) Scientists have discovered how to put together an artificial phage (virus that infects bacteria) with the protein coat of phage T4 and the DNA of phage T2. If this artificial phage infects a bacterium, the new offspring phages produced in the host cell would have:

- A) the protein of T2 and the DNA of T4.
- B) the protein of T4 and the DNA of T2.
- C) a mixture of the DNA and proteins of both phages.
- D) The protein and DNA of T2.
- E) the protein and DNA of T4.

27) In trying to determine whether DNA or protein was the genetic material, Al Hershey and Martha Chase made use of which of the following facts?

- A) DNA does not contain sulfur, whereas protein does.
- B) DNA contains phosphorus, but protein does not.
- C) DNA contains greater amounts of nitrogen than does protein.
- D) A and B only are correct.
- E) A, B, and C are correct.

28) Which functional group is important at the 5' end of a nucleic acid polymer?

- A) hydroxyl B) carbonyl C) phosphate D) carboxyl E) sulfhydryl

Use Figure 16.1 to answer the following questions.

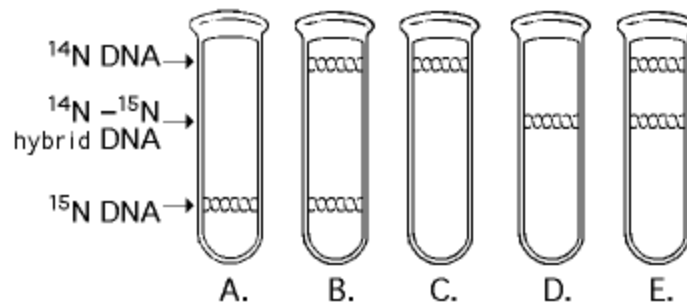


Figure 16.1

- 29) In the late 1950s Meselson and Stahl grew bacteria in a medium containing "heavy" nitrogen (^{15}N) and then transferred them to a medium containing ^{14}N . Which of the results in Figure 16.1 would be expected after one DNA replication in the presence of ^{14}N ?
- 30) A space probe returns with a culture of a microorganism found on a distant planet. Analysis shows that it is a carbon-based life form that has DNA. You grow the cells in ^{15}N medium for several generations and then transfer it to ^{14}N medium. Which pattern in Figure 16.1 would you expect if the DNA was replicated in a conservative manner?
- 31) A biochemist isolated and purified what she thought were the various molecules needed for DNA replication. She then recombined them in appropriate concentrations to replicate DNA *in vitro*. Replication occurred; and when she isolated the product DNA, heated it to break the hydrogen bonds between complementary strands, and electrophoresed the products, she noted that there were not only some long strands but also numerous short segments of DNA a few hundred nucleotides long. What probably went wrong with the *in vitro* replication system she created?
- A) There were no RNA primers.
 - B) No Okazaki fragments formed.
 - C) Too many nucleotides were added.
 - D) The DNA polymerase synthesized only in the $5' \rightarrow 3'$ direction.
 - E) Failure of DNA ligase occurred.
- 32) A new DNA strand only elongates in the $5'$ to $3'$ direction because
- A) DNA polymerase begins adding nucleotides at the $5'$ end.
 - B) Okazaki fragments prevent elongation in the $3'$ to $5'$ direction.
 - C) the polarity of the DNA molecule prevents addition of nucleotides at the $3'$ end.
 - D) replication must progress toward the replication fork.
 - E) DNA polymerase adds nucleotides only to the free $3'$ end.
- 33) A eukaryotic cell lacking telomerase would
- A) have a high probability of becoming cancerous.
 - B) produce Okazaki fragments.
 - C) be unable to replicate.
 - D) undergo a reduction in chromosome length.
 - E) be highly sensitive to sunlight.
- 34) The mechanisms of DNA replication are in great part determined by some "limitations" of DNA polymerase. Which of the following is a DNA polymerase limitation that is NOT a limitation for telomerase?
- A) DNA polymerase only adds to an existing strand
 - B) DNA polymerase must have a template
 - C) DNA polymerase must have a TATA box
 - D) DNA polymerase only adds to the $3'$ end
 - E) DNA polymerase cannot fix errors
- 35) Which of the following characteristics do the telomere and the centromere share in common?
- A) both are tandemly repetitive DNA
 - B) both are synthesized by specific enzymes containing RNA templates
 - C) both are more highly acidic than the rest of the chromosome
 - D) both A and B are correct
 - E) A, B, and C are correct

- 36) Which of the following processes is endergonic?
- A) addition of poly-A tail to mRNA
 - B) polymerization of polypeptides by ribosomes
 - C) activation of a tRNA by a synthetase
 - D) synthesis of mRNA strand from a DNA template
 - E) all of the above

- 1) B
ID: bs2f 7-1
- 2) C
ID: bs2f 7-2
- 3) C
ID: bs2f 7-9
- 4) A
ID: bs2f 7-13
- 5) D
ID: bs2f 7-31
- 6) E
ID: bio6 7.1-10
- 7) B
ID: bio6 7.1-42
- 8) A
ID: bio6 7.1-11
- 9) B
ID: bio6 7.1-13
- 10) C
ID: bio6 7.1-14+
- 11) C
ID: bs2f 11-26
- 12) D
ID: bs2f 11-27
- 13) B
ID: bs2f 11-33
- 14) D
ID: bs2f 11-41
- 15) D
ID: bs2f 11-40
- 16) C
ID: bs2f 11-42
- 17) B
ID: bio6 12.2-3+
- 18) D

ID: bio6 12.1-50

19) E
ID: bio6 12.1-27

20) A
ID: bio6 12.1-47

21) B
ID: bio6 12.1-48

22) C
ID: bio6 12.1-46

23) A
ID: bs2f 14-10

24) A
ID: bs2f 14-19

25) E
ID: bs2f 14-17

26) D
ID: bio6 56.1-16

27) D
ID: bio6 16.1-8

28) C
ID: bio6 57.1-4

29) D
ID: bio6 16.1-23

30) B
ID: bio6 16.1-24

31) E
ID: bs2f 14-29

32) E
ID: bio6 16.1-37

33) D
ID: bio6 16.1-51

34) B
ID: bio6 57.1-8+

35) A
ID: bio6 57.1-7

36) E
ID: bio6 57.1-5

37. Which of the following is a ribozyme?
- A. spliceosome
 - B. telomerase
 - C. ribosome
 - D. A and C above
 - E. All of the above
38. A codon on the template strand of DNA is AGT. The anticodon on the tRNA is:
- A. 3' AGT 5'
 - B. 3' UCA 5'
 - C. 3' AGA 5'
 - D. 3' AGU 5'
 - E. either UCA or AGA, depending on wobble in the first base
39. Which of the following is added post-transcriptionally?
- A. promoter
 - B. polyA tail
 - C. AAUAAA sequence
 - D. AUG codon
 - E. Exon
40. Which of the following is TRUE?
- A. RNA polII uses AUG as the start signal
 - B. Ribosomes initiate translation at the promoter site
 - C. Introns are removed from pre-mRNA before it is translated
 - D. The 5' cap of a eukaryotic mRNA is coded for in the gene
 - E. None of the above is true
41. Proof-reading to correct mistakes is necessary for which of the following?
- A. tRNA
 - B. DNA
 - C. RNA polymerase
 - D. mRNA
 - E. glucose
42. What do RNAs of ribosomes, mRNPs and amino acyl tRNAs have in common?
- A. transcribed from DNA
 - B. required for protein synthesis
 - C. all need proteins to function
 - D. All of the above
 - E. None of the above
43. During initiation of translation, the tRNA that recognizes the initiation codon binds to the:
- A. A site of the ribosome
 - B. P site of the ribosome
 - C. small ribosomal subunit
 - D. second tRNA before attaching to the ribosome
 - E. both A and C are correct

44. When a polypeptide is synthesized, overall synthesis proceeds from its _____ end toward its _____ end.
- A. 3', 5'
 - B. phosphate, hydroxyl
 - C. carboxyl, amino
 - D. amino, carboxyl
 - E. polyA tail, 5' cap end
45. The amino acyl tRNA synthetases must have specific binding/recognition sites for:
- A. mRNA codons
 - B. tRNA anticodons
 - C. amino acids
 - D. both B and C
 - E. all of the above
46. The following bacterial DNA sequence shows a 'gene' encoding a small peptide.

<promoter>
5' (ATGACGTATAA).....TGACCGGTACATGAGTAATACATAAATCAG 3'

How many amino acids long will the small protein encoded by this 'gene' be?

- A. 3
 - B. 4
 - C. 5
 - D. 6
 - E. 7
- For the following questions, select the best answer from the following:

- A. tRNA
- B. mRNA
- C. rRNA
- D. pre-mRNA
- E. both B and D

47. contain(s) exons
48. **contain(s) introns**
49. **bind(s) amino acids**
50. **catalyzes peptide bond formation**
51. **synthesized by RNA pol I**

Answers

- 37. D
- 38. D
- 39. B
- 40. C
- 41. B
- 42. D
- 43. B
- 44. D
- 45. D
- 46. B
- 47. E
- 48. D
- 49. A
- 50. C
- 51. C