

Molecular Genetics Quiz

Choose the response which best answers the question or completes the statement.

1. The process of transformation in bacteria involves
 - (1.) transfer of genes for making a capsule.
 - (2.) infection with a virus called bacteriophage.
 - (3.) production of a cancer cell.
 - (4.) the matting of two different kinds of live bacteria.
2. DNA was first proven to be the transforming factor on bacterial cells by
 - (1.) Meischer
 - (2.) Watson and Crick
 - (3.) Griffin
 - (4.) McClintock
 - (5.) Avery
3. Which is found in RNA but not in DNA?
 - (1.) adenine
 - (2.) cytosine
 - (3.) guanine
 - (4.) uracil
 - (5.) phosphate groups
4. One of Chargaff's rules state
 - (1.) $A + T = G + C$
 - (2.) $A + G = T + C$
 - (3.) $A = G, T = C$
 - (4.) $A = C, T = G$
5. The amount of adenine is always equal to the amount of _____ in DNA.
 - (1.) cytosine
 - (2.) uracil
 - (3.) guanine
 - (4.) thymine
 - (5.) ATP
6. Which statement about DNA is false?
 - (1.) The sugar in DNA has one less oxygen molecule than that in RNA.
 - (2.) DNA is a double stranded molecule.
 - (3.) In DNA, the base uracil replaces thymine.
 - (4.) DNA is a polymer made of nucleotide subunits.

In questions 7 and 8 below, a segment of DNA has one strand with the following sequence of bases.
A G C G C A T A G C A A

7. The complementary strand of DNA is
 - (1.) U C G C G U A U C G U U
 - (2.) T C G C C G A T C G T T
 - (3.) T C G C G T A T C G T T
 - (4.) T C G C A T T A C A U U
 - (5.) T C G W R O N G A C U U
8. The mRNA molecule coded for by the original strand is
 - (1.) T C G C G T A T C G T T
 - (2.) U C G C G U A U C G U U
 - (3.) T C A C M R N A T C C C
 - (4.) U A C A T T U C A G G G
 - (5.) U C G G C A T T U G G C
9. The x-ray diffraction photography of Rosalind Franklin and Maurice Wilkins was critical evidence of DNA
 - (1.) indicating that DNA has a double helix structure.
 - (2.) showing equal number of purines and pyrimidines.
 - (3.) showing the bases of DNA were held together by hydrogen bonds.
 - (4.) revealing the structure of the deoxyribose sugar.
 - (5.) of the location of each adenine, guanine, cytosine, and thymine.
10. In the Watson and Crick model of DNA, the "steps" of the ladder are composed

of (1.) sugars (2.) a purine and a pyrimidine (3.) two purines
(4.) two pyrimidines (5.) a sugar and a phosphate molecule

11. Which statement about DNA replication is **not** correct?
 - (1.) Unwinding of the DNA molecule occurs as hydrogen bonds break.
 - (2.) Replication occurs as each base is paired with another exactly like it.
 - (3.) The process is known as semiconservative replication because one old strand is conserved in the new molecule.
 - (4.) The enzyme that catalyzes DNA replication is DNA polymerase.
 - (5.) Complementary base pairs are held together with hydrogen bonds.

12. In what direction can a DNA polymerase work when catalyzing the addition of nucleotide monomers to build a strand of DNA?
 - (1.) from the 5' toward the 3' end of the new strand being assembled
 - (2.) from the replication centers in two directions called replication forks
 - (3.) from the 3' to the 5' end of the strand being assembled
 - (4.) in both directions if DNA ligase is present

13. The DNA of all organisms replicates by (1.) dispersive replication (2.) reverse replication (3.) semi-conservative replication (4.) conservative replication

14. The scientist(s) most associated with the currently accepted theory of DNA replication is (are)
 - (1.) Darwin and Lamarck
 - (2.) Griffith and Wilkins
 - (3.) Meselson and Stahl
 - (4.) Cartwright and Davis

15. The two sides of the DNA molecule are held together at their bases by:
 - (1.) covalent bonds
 - (2.) peptide bonds
 - (3.) James Bonds
 - (4.) ionic charges
 - (5.) hydrogen bonds

16. Which is **not** a form of ribonucleic acid, or RNA?
 - (1.) messenger RNA
 - (2.) ribosomal RNA
 - (3.) transfer RNA
 - (4.) translation RNA

17. The technology that finally clarified the structure of DNA was (1.) autoradiography (2.) ultracentrifugation (3.) electron microscopy (4.) X-ray diffraction (5.) gel electrophoresis

18. Fred Griffith was able to determine that (1.) DNA was the genetic material (2.) replication was semi-conservative (3.) genetic capabilities could be transferred between bacteria (4.) viruses consist of RNA and proteins (5.) DNA would undergo mutation

19. What kind of bond joins the complementary nucleotides? (1.) ionic bonds (2.) nitrogenous bases (3.) strands of RNA (4.) covalent bonds (5.) hydrogen bonds

20. By estimating the relative quantity of adenine, guanine, cytosine, and thymine in the DNA of various cells, Chargaff played an important role in clarifying the:
 - (1.) genetic code
 - (2.) structure of DNA
 - (3.) mechanism of translation
 - (4.) chemistry of RNA
 - (5.) principle of base-pairing

21. If the sequence of nucleotides in one chain of a DNA molecule is T-C-A-A-G-C, a new nucleotide chain will be produced during replication with the complementary sequence (1.) T-C-A-A-G-C (2.) A-G-T-T-C-G (3.) C-T-G-G-A-T (4.) G-A-C-C-T-A

22. Complementary base pairing links (1.) amino acids (2.) nitrogen containing bases (3.) phosphate groups (4.) proteins
23. Damage to DNA is usually repaired by (1.) purines (2.) nucleotides (3.) enzymes (4.) replication forks
24. During replication, the two strands of DNA separate at a point called a(n) (1.) helicase (2.) purines (3.) replication fork (4.) phosphate group
25. Which does NOT represent a difference between RNA and DNA?
(1.) RNA is single stranded. (2.) RNA contains the sugar ribose.
(3.) RNA utilizes nucleotides in its structure.
(4.) RNA substitutes uracil for thymine.
(5.) All of the above represent differences between DNA and RNA.
26. Which represents a similarity between DNA and RNA?
(1.) Double-stranded helical structure
(2.) The presence of uracil
(3.) The same number of oxygen atoms in each of their pentose sugars
(4.) Nucleotides consisting of a phosphate, sugar, and nitrogenous base
(5.) The relative length of each molecule is similar
27. The structure of DNA is most like a (1.) figure eight (2.) double triangle (3.) double helix (4.) double ellipse (5.) None of the above.
28. The coded information in a DNA molecule directly determines the formation of (1.) polypeptides (2.) polysaccharides (3.) lipids (4.) glycerol (5.) monosaccharides
29. The S form of pneumococcus causes the disease pneumonia in mice, while the R form does not. The series of experiments on the R and S forms of pneumococcus led to the 1944 discovery by Avery, McLeod, and McCarty that
(1.) both R and S forms could cause pneumonia
(2.) S cells had DNA, but R cells did not
(3.) R cells could be transformed by phage
(4.) the transforming factor for R cells is DNA
30. In DNA replication, (1.) each new single helix is composed of 50 percent protein and 50 percent DNA protein. (2.) each new triple helix is composed of one old DNA strand and two new DNA strands. (3.) each new double helix is composed of one old protein strand and one new protein strand. (4.) each new double helix is composed of one old DNA strand and one new DNA strand.
31. Which is a pyrimidine base? (1.) adenine (2.) guanine (3.) thymine (4.) colchicines (5.) None of the previous
32. Which is **not** one of the four bases that makes up DNA? (1.) adenine (2.) uracil (3.) guanine (4.) cytosine (5.) thymine
33. The deoxyribo part in the name deoxyribonucleic acid refers to the (1.) rungs of the sugar ladder (2.) bonds that hold the two strands together (3.) sugar component of DNA (4.) type of helical arrangement

34. Which is a purine base? (1.) cytosine (2.) thymine (3.) adenine
(4.) malomine (5.) All of the previous
35. A nucleotide of DNA could contain (1.) adenine, ribose, and phosphate
(2.) nitrogenous base, phosphate, and glucose
(3.) phosphate, deoxyribose, and thymine
(4.) uracil, deoxyribose and phosphate
36. The correct structure of DNA is a(n) (1.) double helix (2.) tetrahedral
(3.) octagon (4.) single stranded (5.) triple helix
37. The phosphate and sugar groups of a nucleotide are held together by
(1.) ionic bonds (2.) covalent bonds (3.) van der Waals forces
(4.) hydrogen bonds (5.) James Bonds
38. The technology Rosalind Franklin was involved in that finally clarified the
structure of DNA was (1.) autoradiography (2.) ultracentrifugation
(3.) electron microscopy (4.) X-ray diffraction (5.) gel electrophoresis
39. Which is **not** a characteristic of DNA? (1.) cytosine
(2.) long strands of nucleotides (3.) a "backbone" of sugar and phosphate
(4.) uracil (5.) double helix
40. The direction of replication of DNA is (1.) 5' to 3' (2.) 3' to 5' (3.) 5' to 5'
(4.) 3' to 3' (5.) variable
41. The information carried by a DNA molecule is in (1.) the sugars and
phosphates forming its backbone (2.) the total number of nucleotides it
contains (3.) the order of the nucleotides in the molecule (4.) its amino
acid sequence (5.) the RNA units that make up the molecule
42. Which are arranged in the correct order by size, from largest to smallest?
(1.) chromosome - gene - nucleotide - nitrogenous base
(2.) chromosome - gene - nitrogenous base - nucleotide
(3.) codon - chromosome - gene - nucleotide
(4.) nucleotide - chromosome - gene - codon
(5.) gene - chromosome - nucleus - nucleotide
43. The term replication refers to DNA's ability to (1.) respond to X-ray photography
(2.) attack bacteriophages (3.) make copies of itself (4.) twist into a helix
44. If a change is made when DNA copies itself, a _____ results.
(1.) clone (2.) death (3.) mutation (4.) base pair
45. A section of DNA with bases A-T-T-C-G-C will line up with bases
(1.) T-A-A-G-G-C (2.) A-T-T-C-G-C (3.) T-A-A-G-C-G
(4.) T-A-A-G-C-C
46. Which of the following nucleotide bases is found only in RNA, not in DNA?
(1.) guanine (2.) adenine (3.) thymine (4.) uracil (5.) cytosine

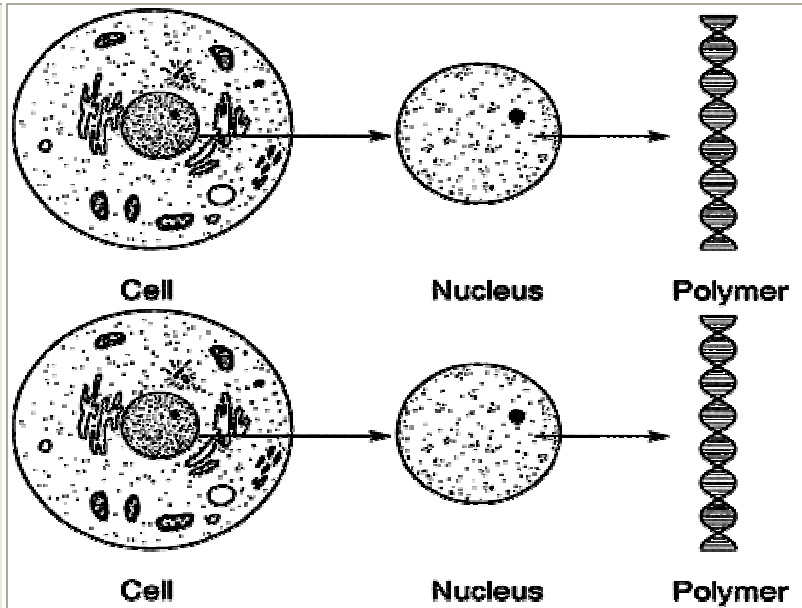
47. Each nucleotide in a DNA molecule is composed of (1.) a nitrogenous base and a phosphate group (2.) a sugar called ribose, a nitrogenous base, and a phosphate group (3.) a sugar called deoxyribose, a nitrogenous base, and a phosphate group (4.) a sugar called deoxyribose and a phosphate group (5.) deoxyribose and a nitrogen base.
48. The bases on one strand of DNA are CTAGAAC. The complementary section on the other strand of DNA is (1.) CTAGAAC (2.) AGCTCCA (3.) GATCTTG (4.) TCGAGGT (5.) GUTCTTG.
49. Covalent bonds between the nucleotides of new DNA strands are formed by enzymes called (1.) pyrimidines (2.) purines (3.) nucleotides (4.) transforming factors (5.) DNA polymerases.
50. DNA replication occurs, ensuring that cells in a multicellular organism carry the same genetic information. (1.) in a few hours (2.) slowly (3.) before a cell divides (4.) after completed cell division
51. Which of the following nucleotide bases is found only in DNA, not in RNA? (1.) guanine (2.) adenine (3.) thymine (4.) uracil (5.) cytosine
52. Any change in a nucleotide sequence of DNA is called (1.) mutagen (2.) replication (3.) duplication (4.) splicing (5.) mutation
53. If a DNA molecule contains 20% A, approximately what percentage of G is present? (1.) 20% (2.) 40% (3.) 30% (4.) 60%
54. If a nucleic acid is found to contain 20% A and 20% T, the molecule is probably (1.) single-stranded DNA. (2.) double-stranded DNA. (3.) single-stranded RNA. (4.) double-stranded RNA.
55. Replication proceeds in a ____ to ____ direction. (1.) 3' to 3' (2.) 3' to 5' (3.) 5' to 3' (4.) 5' to 5'
56. During DNA replication, synthesis of the lagging strand is discontinuous and forms short segments of DNA known as (1.) primer fragments (2.) Okazaki fragments (3.) replication forks. (4.) beta structures (5.) replication bubbles.
57. In 1953, Watson and Crick speculated that the hereditary information is contained in what feature of DNA? (1.) the sequence of nitrogenous bases (2.) the hydrogen bonding between nitrogenous bases (3.) the alpha helical structure (4.) the antiparallel nature of the strands (5.) sugar backbone of the strands

Use the information provided in the diagram below at the right and your knowledge of biology to answer questions 58 through 60 which follow?

58. The structure and location of a cellular component is represented in the diagram shown. The polymer in the diagram most likely contains (1.) adenosine triphosphate (2.) genes (3.) lipids (4.) hydrolytic enzymes

59. Name the polymer pictured at the right and name one reason for your answer based on the structure of this polymer.

60. What repeating subunits make up this polymer?



Match each of the following terms with a statement from the list provided which best associates with that term. Place the letter of that statement in the blank on your answer sheet.

- 61. polypeptide
- 62. template
- 63. replication
- 64. triplet
- 65. cloning
- 66. alpha helix

- A. another name for a protein
- B. to make a copy of DNA
- C. a long starch molecule
- D. something which is copied
- E. sequence of nitrogenous bases which codes for an amino acid
- F. an identical organism copy
- G. the shape of DNA

67. Which statement about mutations is most correct? (1.) Most mutations are recessive and beneficial. (2.) Mutations are sources of variations in offspring. (3.) Mutations occur in only fruit flies and molds. (4.) Mutations can not occur unless the mutating cell is exposed to ionizing radiation.

Use the diagram below at the right and your knowledge of biology to answer questions 68 through 73 which follow. The diagram represents molecules involved in protein synthesis.

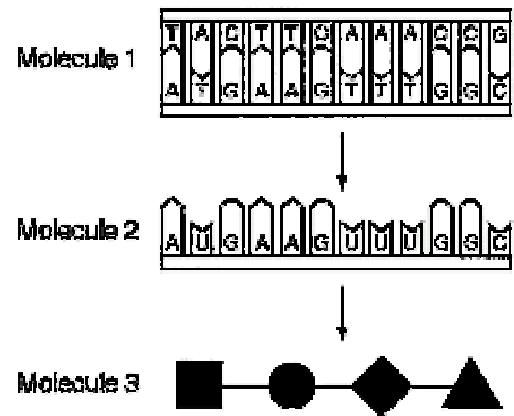
68. In plant cells, molecule 1 is found in the (1.) centriole (2.) cell wall (3.) nucleus (4.) ribosome

69. The building blocks of molecule 3 are known as (1.) amino acids (2.) nucleotides (3.) fatty acids (4.) monosaccharides

70. Where do the chemical reactions that are coded for by molecule 2 take place? (1.) in the vacuole (2.) in the lysosome (3.) on the plasma membrane (4.) at ribosomes

71. Molecule 2 is RNA. List two reasons it can be easily determined this molecule is RNA by looking at its structure.

72. Molecule 3 is known as (1.) DNA (2.) RNA (3.) a polypeptide (4.) a fatty acid



Use the diagram below at the right and your knowledge of biology to answer questions 73 through 75 which follow.

73. Which processes occur in the nucleus?

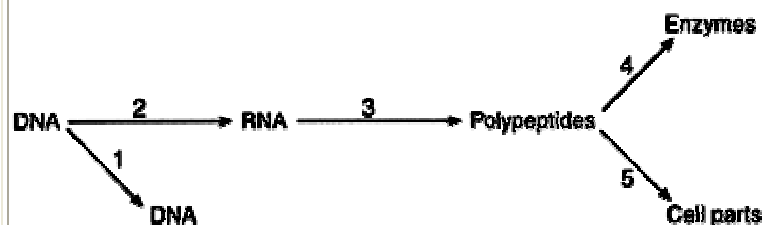
- (1.) 1 and 2 (2.) 3 and 4
(3.) 2 and 3 (4.) 4 and 5

74. Process 1 is known as

- (1.) replication
(2.) nondisjunction (3.) mutation
(4.) translocation

75. What is the product of process 3?

- (1.) a strand of DNA
(2.) a strand of RNA
(3.) two strands of DNA
(4.) a chain of amino acids



Correctly complete the statements below .

1. The fact that adenine bonds with thymine and guanine with cytosine provides an example of the concept of _____ base pairing.

2. DNA is a polymer made up of _____ subunits.

3. The currently most accepted theory of DNA replication is that of _____ replication.

4. A pattern of a single strand of DNA or RNA used in the replication process is called a(n) _____.

5. The currently most accepted theory of DNA replication was supported by experimental work completed by _____ and Stahl.
6. In RNA, the base uracil replaces the base _____.
7. RNA is a _____ stranded molecule.
8. The sugar found in the DNA molecule is called _____.
9. The enzyme _____ separates the DNA strands thus allowing the replication process to occur.
10. The fact that adenine/thymine and guanine/cytosine are found in relatively equal percentages in a cell is a statement of a concept first proposed by _____.
11. The _____ is the region of a DNA strand where the replication process is occurring.
12. Short fragments of DNA which are replicated discontinuously in the lagging strand are known as _____.