LECTURE 17 – Nucleic Acids

QUESTIONS TO TRY FOR PRACTICE

1) Nucleic acids are polymers made up of which of the following monomers?
A) nucleotides
B) sugars
C) amino acids
D) nitrogenous bases

2) What is the difference between a ribonucleotide and a deoxyribonucleotide?
A) Ribonucleotides contain a phosphate group.
B) Ribonucleotides have a hydroxyl group on the 2 carbon of their sugar subunit.
C) Ribonucleotides contain a sugar with five carbon atoms.
D) Ribonucleotides have a hydrogen atom on the 1 carbon of their sugar subunit.

3) Which of the following nitrogenous bases are purines?
A) cytosine and uracil
B) cytosine and thymine
C) cytosine, uracil, and thymine
D) adenine and guanine

4) Which of the following includes all of the pyrimidines found in RNA and/or DNA?
A) cytosine and uracil
B) cytosine and thymine
C) cytosine, uracil, and thymine
D) cytosine, uracil, and guanine

5) Which of the following nitrogenous bases is found in RNA, but not DNA?
A) thymine
B) adenine
C) uracil
D) guanine

6) A nucleotide is made up of which of the following subunits?
A) a 5-carbon sugar, a phosphate group, and a nitrogenous base
B) a 5-carbon sugar and a phosphate group
C) a 5-carbon sugar and a nitrogenous base
D) a 5-carbon sugar, an amino group, and an "R-group"

7) By convention, the sequence of bases in a nucleic acid is always written in which direction?
A) amino to carboxyl
B) carboxyl to amino
C) 3' → 5'
D) 5' → 3'

8) What is the difference (if any) between the structure of ATP and the structure of the precursor of the A nucleotide in RNA?
A) The sugar molecule is different.
B) The nitrogen-containing base is different.
C) The number of phosphates is three instead of one.
D) The number of phosphates is three instead of two.
E) There is no difference.

9) What forms the "backbone" of a nucleic acid?
A) a chain of sugar and phosphate groups, linked through phosphodiester bonds
B) purine and pyrimidine pairs, hydrogen-bonded to each other
C) a chain of amino and carboxyl groups, linked via peptide bonds
D) a double helix of antiparallel strands

10) Nucleic acids have a definite polarity, or directionality. Stated another way, one end of the molecule is different from the other end. How are these ends described?
A) One end has a hydroxyl group on the 2 carbon; the other end has a hydrogen atom on the 2 carbon.
B) One end contains a nitrogenous base; the other end lacks it.
C) One end has an unlinked 3 carbon; the other end has an unlinked 5 carbon.
D) One end has one phosphate group; the other end has two phosphate groups.

11) What feature of mononucleotides provides the energy needed for polymerization when nucleic acids are formed?
A) their methyl groups
B) their sugar groups
C) their nitrogenous bases
D) their phosphate groups

12) If one strand of a DNA molecule has the sequence of bases 5'ATTGCA3', the other complementary strand would have the sequence
A) 5'TAACGT3'.
B) 5'TGCAAT3'.
C) 5'UAACGU3'.
D) 3'UAACGU5'.
E) 5'UGCAAU3'.

13) Which of the following statements about the 5' end of a polynucleotide strand of RNA is correct?
A) The 5' end has a hydroxyl group attached to the number 5 carbon of ribose.
B) The 5' end has a phosphate group attached to the number 5 carbon of ribose.
C) The 5' end has phosphate attached to the number 5 carbon of the nitrogenous base.
D) The 5' end has a carboxyl group attached to the number 5 carbon of ribose.
E) The 5' end is the fifth position on one of the nitrogenous bases.

14) Which of the following statements best summarizes the differences between DNA and RNA?
A) DNA encodes hereditary information, whereas RNA does not.
B) The bases in DNA contain sugars, whereas the bases in RNA do not contain sugar.
C) DNA nucleotides contain a different sugar than RNA nucleotides.
D) DNA contains the base uracil, whereas RNA contains the base thymine.
E) The bases in DNA contain sulfur, whereas the bases in RNA do not contain sulfur.

15) Which of these scientists was not directly involved in the discovery of DNA's structure?
A) James Watson
B) Rosalind Franklin
C) Sidney Altman
D) Francis Crick
E) Maurice Wilkins

16) Which of the following best describes DNA's secondary structure?
A) β-pleated sheet
B) double parallel helical strands
C) turn-loop-turn
D) double antiparallel helical strands

17) Why is DNA said to be antiparallel?
A) The two strands of DNA are joined together via complementary base pairing such that AT run in the 3'5' direction and CG run in the 5'3' direction.
B) The DNA strands twist into a helix conformation once the bases have joined to form major and minor grooves.
C) Each strand of the double helix is made up of a sugar phosphate backbone which runs in the 5'3' direction.
D) DNA has polarity such that one strand runs in the 3'5' direction and the other in the 5'3' direction.

18) What is the structural feature that allows DNA to replicate?
A) sugar-phosphate backbone
B) complementary pairing of the nitrogenous bases
C) disulfide bonding (bridging) of the two helixes
D) twisting of the molecule to form an α-helix
E) three-component structure of the nucleotides

19) If DNA is heated to 95°C, the bonds between complementary strands break, resulting in two single strands of DNA. In this process, which bases will separate first because they have less hydrogen bonds between them?
A) adenine and cytosine
B) adenine and thymine
C) guanine and cytosine
D) guanine and thymine

20) If a molecule of DNA contains 10% cytosine, it has _____ guanine and _____ adenine respectively.
A) 10%; 40%
B) 10%; 45%
C) 40%; 40%
D) 40%; 10%
E) 10%; 80%
Answer: A

21) What is responsible for holding the two strands together in the DNA double helix?
A) phosphodiester bonds
B) hydrogen bonds
C) ionic bonds
D) covalent bonds

22) In the context of chemical evolution, DNA's structure is interesting because it suggests a possible copying mechanism. What about DNA's structure facilitates copying?
A) It has the same number of purines and pyrimidines.
B) The nitrogenous bases are located on the inside of the double helix.
C) The strands of the double helix are complementary.
D) DNA always goes from 5 to 3.

23) Although DNA is the main hereditary material in all life-forms, it lacks one important characteristic to make it a candidate for the first life-form. Why have researchers rejected the idea that DNA was found in the first life-form?
A) It does not function as a catalyst.
B) It is not stable enough to have withstood early Earth's harsh atmosphere.
C) Because it has only four different bases, it does not carry enough information; therefore, it cannot adapt and evolve.
D) The type of sugar found in DNA is much too complicated to have been present early in Earth's history.

24) The "information system" of the cell involves stable genetic information being stored as _____, which can be used to make a "disposable" (relatively short-lived) copy of this information as _____.
A) RNA; DNA
B) DNA; DNA
C) DNA; RNA
D) RNA; RNA

25) Why do many researchers consider RNA to be the best candidate for the first life-form?
A) It is simple in structure.
B) It is capable of self-replication and catalysis.
C) It carries more information than any other molecule.
D) All of its nucleotide components have been created under laboratory conditions that mimic early Earth.

26) Which of the following is not a difference between RNA and DNA?
A) One is typically single stranded and the other is typically double stranded.
B) One contains uracil and the other does not.
C) One contains ribose sugar and the other contains deoxyribose sugar.
D) One is made from nucleotide monomers and the other is not.

27) Why is DNA more appropriate than RNA as the information storing molecule of the cell?
A) RNA is more stable than DNA and has the ability to catalyze reactions.
B) DNA has the ability to catalyze reactions and make proteins.
C) RNA has only four different bases and thus cannot carry enough information.
D) DNA is far less reactive than RNA, and thus the information sequence is more stable.

28) Hairpins and stem-and-loop patterns make up what part of RNA's structure?
A) primary
B) secondary
C) tertiary
D) quaternary

29) The term ribozyme describes what property of RNA molecules?
A) single-stranded
B) catalytic
C) its shape
D) the fact that part of RNA molecules can be double-stranded similar to DNA

30) Which one of the following is not a way that RNA is seen as intermediate between DNA and proteins?
A) RNA contains genetic information like DNA, but is not as stable.
B) RNA can catalyze reactions, but not as well as proteins.
C) RNA is composed of nucleotides, but forms tertiary and quaternary structures like a protein.
D) RNA has 5 and 3 termini like DNA, but it also has amino and carboxy termini like protein.