7.1

Write true if the statement is true or false if the statement is false.

_____ 1. For many decades, scientists thought that proteins were the genetic material.

_____ 2. In eukaryotic cells, proteins always remain in the nucleus, but DNA is made at ribosomes in the cytoplasm.

_____ 3. RNA is much larger than DNA.

_____ 4. Erwin Chargaff demonstrated that in DNA, the amount of adenine is about the same as the amount of guanine.

_____ 5. The shape of DNA is similar to a spiral staircase, and is referred to as a double helix.

_____ 6. Because of Chargaff’s rules, if the order of bases on one strand of DNA is known, the order of bases on the other strand can be predicted.

_____ 7. There are 4 types of RNA: mRNA, rRNA, sRNA, and tRNA.

_____ 8. Proteins are made on the ribosomes in the cytoplasm.

_____ 9. In DNA replication, half of the parent DNA molecule is conserved in each of the two daughter DNA molecules.

_____ 10. mRNA is a copy of the genetic instructions from the DNA.

_____ 11. Oswald Avery was the first to conclude that DNA is the genetic material.

_____ 12. James Watson and Francis Crick used X rays to learn about DNA’s structure.

_____ 13. RNA uses the instructions in DNA to make a protein.

_____ 14. If one strand of DNA is GAATTC, the opposite strand would be CTAAAG.

_____ 15. DNA contains instructions for all the proteins your body makes.
Read these passages from the text and answer the questions that follow.

DNA

DNA is the genetic material in your cells. It was passed on to you from your parents and determines your characteristics. The discovery that DNA is the genetic material was another important milestone in molecular biology.

Griffith Searches for the Genetic Material

Many scientists contributed to the identification of DNA as the genetic material. In the 1920s, Frederick Griffith made an important discovery. He was studying two different strains of a bacterium, called R (rough) strain and S (smooth) strain. He injected the two strains into mice. The S strain (virulent) killed the mice, but the R strain (nonvirulent) did not (see the figure below). Griffith also injected mice with S-strain bacteria that had been killed by heat. As expected, the killed bacteria did not harm the mice. However, when the dead S-strain bacteria were mixed with live R-strain bacteria and injected, the mice died.

Griffith’s Experimental Results. Griffith showed that a substance could be transferred to harmless bacteria and make them deadly. (Image courtesy of CK-12 Foundation and under the Creative Commons license CC-BY-NC-SA 3.0.)

Based on his observations, Griffith deduced that something in the killed S-strain was transferred to the previously harmless R-strain, making the R-strain deadly. What was that something? What type of substance could change the characteristics of the organism that received it?

Hershey and Chase Seal the Deal

The conclusion that DNA is the genetic material was not widely accepted at first. It had to be confirmed by other research. In the 1950s, Alfred Hershey and Martha Chase did experiments with viruses and bacteria. Viruses are not cells. They are basically DNA inside a protein coat. To reproduce, a virus must insert its own genetic material into a cell (such as a bacterium). Then it uses the cell’s machinery to make more viruses. The researchers used different radioactive elements to label the DNA and proteins in viruses. This allowed them to identify which molecule the viruses inserted into bacteria. DNA was the molecule they identified. This confirmed that DNA is the genetic material.
7.1 Critical Reading (page 2)

Questions - Answer in complete sentences and good handwriting.

1. In Griffith's experiments, what killed the mice?

2. Why did the rough strain and heat-killed smooth strain kill the mice?

3. Why are viruses not considered cells?

4. What were the results of Hershey and Chase's experiment?

5. The term given to Griffith’s observations is transformation. Why do you think that term is appropriate?
7.1 Multiple Choice

Circle the correct choice.

1. The order of experiments proving that DNA is the genetic material is
   Avery → Griffith → Hershey and Chase.
   Hershey and Chase → Griffith → Avery.
   Griffith → Avery → Hershey and Chase.
   Griffith → Hershey and Chase → Avery.

2. Chargaff’s rules state that
   the amount of adenine equals the amount of thymine.
   the amount of adenine equals the amount of guanine.
   the amount of thymine equals the amount of guanine.
   the amount of cytosine equals the amount of thymine.

3. Which of the following statements concerning DNA is correct? (1) DNA contains instructions for all the proteins your body makes. (2) The shape of DNA is a double helix. (3) The central dogma of molecular biology states RNA → DNA → Protein.
   1 only
   1 and 2
   2 and 3
   1, 2, and 3

4. The structure of DNA was identified by
   Rosalind Franklin.
   Erwin Chargaff.
   Alfred Hershey and Martha Chase.
   James Watson and Francis Crick.

5. If one strand of DNA is CAGGGTACG, the opposite strand is
   GTTCGAATGC.
   GTCCATAGC.
   CAGGTTACG.
   GTCGTTACG.

6. The subunits of DNA are nucleotides consisting of
   a sugar, a carbon group, and a nitrogen-containing base.
   a sugar, a phosphate group, and a nitrogen-containing base.
   a sugar, a phosphate group, and an oxygen-containing base.
   a lipid, a phosphate group, and a nitrogen-containing base.

7. Differences between DNA and RNA include which of the following? (1) RNA consists of one nucleotide chain. (2) RNA contains the nitrogen base uracil instead of thymine. (3) RNA contains the sugar ribose instead of deoxyribose.
   1, 2, and 3
   1 and 2
   2 and 3
   2 only

8. The types of RNA include
   messenger RNA.
   nuclear RNA.
   cytoplasmic RNA.
   all of the above
7.1 Vocabulary I

Match the vocabulary word with the proper definition.

Definitions

_____ 1. the shape of DNA
_____ 2. found that there exists a substance that could change the characteristics of another organism
_____ 3. helps form ribosomes
_____ 4. used X rays to learn more about DNA’s structure
_____ 5. subunit of DNA
_____ 6. DNA → RNA → Protein
_____ 7. brings amino acids to ribosomes
_____ 8. confirmed that DNA is the genetic material
_____ 9. the amount of A = T, and the amount of C = G
______ 10. copies the genetic instructions from DNA in the nucleus, and carries the instructions to the cytoplasm
_____ 11. discovered the shape of DNA
_____ 12. the process in which DNA is copied

Terms

a. central dogma of molecular biology
b. Chargaff’s rules
c. DNA replication
d. double helix
e. Franklin
f. Griffith
g. Hershey and Chase
h. messenger RNA (mRNA)
i. nucleotide
j. ribosomal RNA (rRNA)
k. transfer RNA (tRNA)
l. Watson and Crick

How you may feel

About all this DNA stuff!

Image credit: http://www.lab-initio.com/permission given for educational, non-profit purposes
Fill in the blank with the appropriate term.

1. In DNA, A always pairs with ____________, and G always pairs with ____________.

2. The DNA molecule has a double ____________ shape.

3. Griffith showed that a substance could be transferred to harmless bacteria and make them ____________.

4. DNA → RNA → ____________

5. ____________ and Chase confirmed that DNA is the genetic material.

6. The amount of A equals the amount of T and the amount of G equals the amount of C is known as ____________ rules.

7. ____________ RNA copies the genetic instructions from DNA in the nucleus, and carries them to the cytoplasm.

8. Proteins are made in the cytoplasm on small organelles called ____________.

9. ____________ contains the nitrogen base uracil.

10. ____________ RNA helps form ribosomes,

11. ____________ RNA brings amino acids to ribosomes,

12. DNA stands for ____________.