Lesson Self-Check

CAN YOU EXPLAIN IT?

FIGURE 17: Computer programmers develop coded instructions that a computer uses to perform a task. Similarly, DNA is the genetic code that cells use for protein synthesis.

You have explored the cellular process that produces proteins from DNA code. In many ways it is similar to the way that humans translate our language into a language that computers can understand. The binary code that computers understand is made up of zeroes and ones, sometimes called machine code. However, computer programmers do not typically write programs directly in this binary code. Instead, they use programming languages, such as C++ or JavaScript, which act as translators between the programmer and the computer.

Explain Refer to the notes in your Evidence Notebook to answer the following questions to explain how the language of DNA is translated to the language of proteins and how this process compares to computer programming.

1. How does the four-letter DNA language encode instructions for making thousands of different proteins?
2. Which molecules act as the translators in the process of protein synthesis?
3. How is the process of protein synthesis similar to the process of programming a computer? How is it different?

CHECKPOINTS

Check Your Understanding

1. A student is planning to draw a model of DNA and a model of RNA. Which of the following should the student include in the DNA model and NOT the RNA model?

a. a double helix
b. the nucleotide uracil
c. the sugar ribose
d. a phosphate group

2. Which of the following is evidence that would support the claim that DNA has been transcribed into RNA?

a. A temporary, complementary copy of the DNA has been produced.
b. An exact, permanent copy of the DNA has been produced.
c. A complementary, permanent copy of RNA has been produced and it replaces DNA.

3. Which statement correctly compares the impact of frameshift mutations and point mutations on polypeptides?

a. Point mutations have a greater impact because they always change the resulting protein.
b. Frameshift mutations have a greater impact because they always substitute the first nucleotide in a codon.
c. Frameshift mutations have a greater impact because they shift the entire codon sequence following them.
d. Point mutations have a greater impact because they always cause a change in the amino acid sequence.

4. Place these steps in order to describe the process of transcription.

a. RNA polymerase uses the DNA strand as a template to synthesize a complementary strand of RNA.
b. The RNA strand grows until an entire gene has been trascribed.
c. The complex of RNA polymerase and proteins breaks apart.
d. The DNA is unwound and a specific sequence of nucleotides is sequenced along the promoter.
e. A large complex consisting of RNA polymerase and other proteins assembles on the DNA strand.

5. Draw a model showing how the three types of RNA interact to translate an mRNA code into a sequence of amino acids.

6. Which flow chart best summarizes the process of protein synthesis?

a. rRNA → DNA → mRNA
b. Protein → mRNA → DNA
c. mRNA → DNA → protein
d. DNA → mRNA → protein

7. Fill in the correct terms to complete this statement about eukaryotes. Some terms may be used more than once.

cytoplasm, amino acids, nucleus, ribosomes, mRNA, DNA, protein

DNA replication occurs in the _____ of the cell and produces two identical strands of _____. Protein synthesis is made up of two stages. Transcription occurs within the _____ and uses the DNA template to make a complimentary strand of _____. This molecule leaves the nucleus and enters the cell's _____ where _____ read along the strand of nucleotides. tRNA molecules bearing _____ enter the ribosome. The subunits are linked together to make a polypeptide, which is modified to make the final _____.

MAKE YOUR OWN STUDY GUIDE

In your Evidence Notebook, design a study guide that supports the main idea from this lesson:

Protein synthesis consists of two stages. In the first stage, the DNA code is transcribed to make an mRNA strand. The mRNA strand is then translated into a sequence of amino acids.

Remember to include the following information in your study guide:

- Use examples that model main ideas.
- Record explanations for the phenomena you investigated.
- Use evidence to support your explanations. Your support can include drawings, data, graphs, laboratory conclusions, and other evidence recorded throughout the lesson.

Consider how models of protein synthesis can be used to determine the inputs and outputs at each step, as well as where each step of the process occurs in the cell.