Roland-Story Biology Class
Chapter 10 Study Guide
How Proteins are Made

Name _____

Section: From Genes to Proteins

In the space provided, write the letter of the description that best matches the term or phrase.

_____ **1.** ribonucleic acid (RNA)

_____ **2.** uracil

_____ **3.** transcription

_____ **4.** translation

_____ **5.** gene expression

a. the entire process by which proteins are made
b. a molecule made of linked nucleotides
c. the process of reading instructions on an RNA molecule to put together the amino acids that make up a protein
d. the process of transferring a gene's instructions for making a protein to an RNA molecule
e. a nitrogen base used in RNA instead of the base thymine found in DNA

Complete each statement by underlining the correct term or phrase in the brackets.

6. Transcription begins when [RNA / RNA polymerase] binds to the gene's promoter.

7. RNA polymerase adds complementary [DNA / RNA] nucleotides as it "reads" the gene.

8. In eukaryotes, transcription takes place in the [nucleus / cytoplasm].

Read each question, and write your answer in the space provided.

9. What are two differences between transcription and DNA replication?

10. What determines where on the DNA molecule transcription begins and where it ends?

In the space provided, explain how the terms in each pair are related to each other.

11. RNA, messenger RNA

12. codons, genetic code

Study the following six steps in the synthesis of proteins. Determine the order in which the steps take place. Write the number of each step in the space provided.

_____**13.** The codon in the vacant A site receives the tRNA molecule with the complementary anticodon. The tRNA carries the amino acid specified by the codon.

_____**14.** Steps 2–5 are repeated until a stop codon is reached. The newly made protein is released into the cell.

_____**15.** The tRNA at the P site detaches, leaves behind its amino acid, and moves away from the ribosome.

_____**16.** Enzymes help form a peptide bond between the amino acids of adjacent tRNA molecules.

_____ **17.** The tRNA (with its protein chain) in the A site moves over to fill the empty P site. A new codon is present in the A site, ready to receive the next tRNA and its amino acid.

_____**18.** An mRNA, two ribosomal subunits, and a tRNA carrying a modified form of the amino acid methionine bind together. The tRNA bonds to the "start" codon AUG.

Section: Gene Regulation and Structure

Complete each statement by writing the correct term or phrase in the space provided.

1. To break down lactose, *Escherichia coli* need three different _____ , each of which is coded for by a different gene.

2. The three genes are located next to each other, and all are controlled by the same _____ site.

3. The piece of DNA that overlaps the promoter site and serves as the on-off switch is called a(n) _____.

4. The group of genes that codes for enzymes involved in the same function, their promoter site, and the operator all function together as a(n) _____.

5. The operon that controls the metabolism of lactose is called the _____.

6. A(n) _____ is a protein that binds to an operator and physically blocks RNA polymerase from binding to a promoter site.

Read each question, and write your answer in the space provided.

7. What are enhancers?

8. Why is there more opportunity for gene regulation in eukaryotic cells than in prokaryotic cells?

9. Why have no operons been found in eukaryotic cells?

10. When can gene regulation occur in eukaryotic cells?

11. What are introns and exons?

12. What happens to mRNA that includes introns?

13. What might be the evolutionary advantage of genes being interrupted by introns?

Complete each statement by underlining the correct term or phrase in the brackets.

14. Mutations can only be passed on to offspring if they occur in [gametes / body cells].

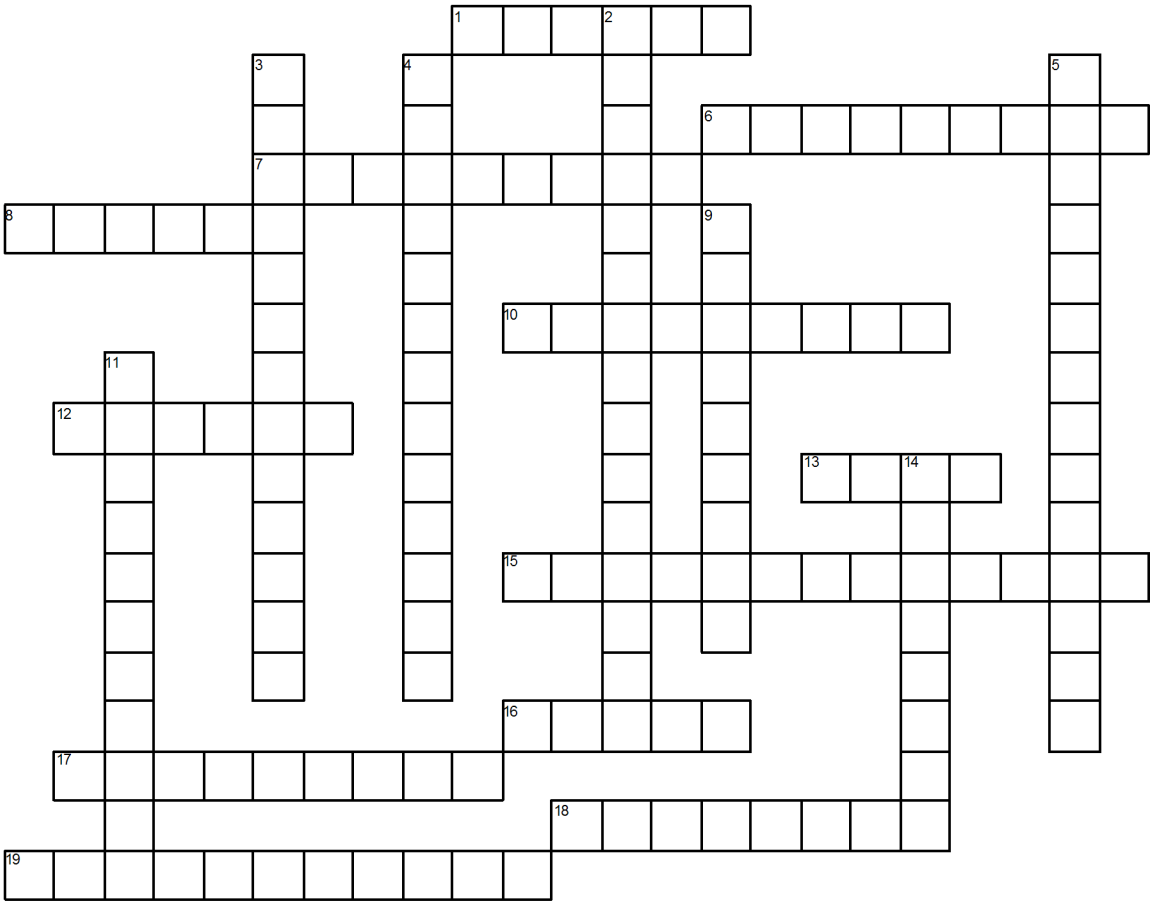
15. Mutations that change one or just a few nucleotides in a gene on a chromosome are called [random / point] mutations.

16. If a mutation causes a gene containing the nucleotide sequence ACA to become ACT, the mutation is called a [substitution / deletion] mutation.

17. If a mutation causes a sequence of nucleotides to change from ACGAGA to ACGGA, the mutation is called a(n) [insertion / deletion] mutation.

18. If a mutation causes a sequence of nucleotides to change from ACGAGA to ACGAGGA, the mutation is called a(n) [insertion / deletion] mutation.

19. Crossword puzzle of vocabulary words:



Clues on the next page

ACROSS

1 a section of DNA in a gene that does not code for any amino acids and that is transcribed into RNA but is removed before it is translated
6 a type of RNA that carries to the ribosomes the information to make a protein
7 an area on a tRNA molecule that consists of three bases that are complementary to the codon of mRNA
8 a unit of gene regulation and transcription in bacterial DNA that is made up of a promoter, an operator, and one or more structural genes
10 a gene system whose operator gene and three structural genes control lactose metabolism in E. coli
12 one of the four bases that combine with sugar and phosphate to form a nucleotide subunit of RNA; uracil pairs with adenine
13 a section of DNA in a gene that codes for the amino acids in a protein and for the beginning and the end of a coding sequence
15 an enzyme that starts (catalyzes) the making of RNA by using a strand of a DNA molecule as a template
16 a three-nucleotide sequence on an mRNA molecule that codes for an amino acid or signifies a start signal or a stop signal
17 a type of RNA that, together with proteins, makes up a ribosome; ribosomes coordinate the joining of tRNA molecules to mRNA codons when proteins are made
18 a type of RNA that transfers amino acids to the growing end of a protein chain during translation
19 the rule that describes how the order of nucleotides, read in groups of three consecutive nucleotides (triplets) that correspond to specific amino acids, specifies the order of amino acids in a protein

DOWN

2 a molecule made up of a chain of nucleotides; RNA plays a role in protein synthesis
3 the process of making RNA by using one strand of a DNA molecule as a template
4 a mutation in which only one nucleotide or nitrogenous base in a gene is changed
5 the display of the genetic material of an organism in the form of specific traits
9 a regulatory protein that binds to an operator and blocks transcription of the genes of an operon
11 the part of protein synthesis that takes place at ribosomes and that uses the codons in mRNA molecules to specify the sequence of amino acids in polypeptide chains
14 a short sequence of viral or bacterial DNA to which a repressor binds to prevent transcription (mRNA synthesis) of a gene in an operon