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Name _____ Class _____ Date _____

Skills Worksheet

Protein Synthesis

INTERPRETING TABLES

Use the table below to complete items 1–17.

Codons in mRNA

First base	Second base: U	Second base: C	Second base: A	Second base: G	Third base
U	UUU, UUC – Phenylalanine UUA, UUG – Leucine	UCU, UCC, UCA, UCG – Serine	UAU, UAC – Tyrosine UAA, UAG – Stop	UGU, UGC – Cysteine UGA – Stop UGG – Tryptophan	U C A G
C	CUU, CUC, CUA, CUG – Leucine	CCU, CCC, CCA, CCG – Proline	CAU, CAC – Histidine CAA, CAG – Glutamine	CGU, CGC, CGA, CGG – Arginine	U C A G
A	AUU, AUC, AUA – Isoleucine AUG – Start	ACU, ACC, ACA, ACG – Threonine	AAU, AAC – Asparagine AAA, AAG – Lysine	AGU, AGC – Serine AGA, AGG – Arginine	U C A G
G	GUU, GUC, GUA, GUG – Valine	GCU, GCC, GCA, GCG – Alanine	GAU, GAC – Aspartic acid GAA, GAG – Glutamic acid	GGU, GGC, GGA, GGG – Glycine	U C A G

Complete the table below showing sequences of DNA, mRNA codons, anticodons, and corresponding amino acids. Use the list of mRNA codons in the table above to assist you in completing this exercise. Remember that the genetic code is based on mRNA codons.

Decoding DNA

DNA	**1.** _____	**2.** _____	GAT	**3.** _____
mRNA codon	**4.** _____	**5.** _____	**6.** _____	UAU
Anticodon	**7.** _____	UUC	**8.** _____	**9.** _____
Amino acid	Tryptophan	**10.** _____	**11.** _____	**12.** _____

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Protein Synthesis *continued*

Determine how the mutations below will affect each amino acid sequence. Use the mRNA codons in the table on the previous page to complete items 13–16 below. In the space provided, write the names of the amino acids that correspond to each mRNA sequence and mutation given. An example is provided for you.

Example:

mRNA sequence:	UGU-CCG	cysteine-proline
mutation sequence:	UGC-CGC	cysteine-arginine

13.	mRNA sequence:	GAA-CGU	_____
	mutation sequence:	GAU-CGU	_____
14.	mRNA sequence:	AUC-UGC	_____
	mutation sequence:	AUC-UGG	_____
15.	mRNA sequence:	UGU-CCU-CCU	_____
	mutation sequence:	UGU-UUC-CCU	_____
16.	mRNA sequence:	GGG-UUA-ACC	_____
	mutation sequence:	GGU-UAA	_____

17. What kind of mutation occurred to the mRNA sequence in item 16 above? Explain.

_____

_____

_____

_____

_____

_____

DNA Structure

INTERPRETING DIAGRAMS

1. **A.** phosphate group
   B. pyrimidine (thymine)
   C. hydrogen bond
   D. purine (adenine)
   E. deoxyribose
2. the hydrogen bonds between the bases; cytosine and guanine form three hydrogen bonds, whereas adenine and thymine form only two hydrogen bonds.
3. TAA-GGC

Protein Synthesis

INTERPRETING TABLES

1. ACC
2. TTC
3. ATA
4. UGG
5. AAG
6. CUA
7. ACC
8. GAU
9. AUA
10. lysine
11. leucine
12. tyrosine
13. glutamic acid-arginine to aspartic acid-arginine
14. isoleucine-cysteine to isoleucine-tryptophan
15. cysteine-proline-proline to cysteine-phenylalanine-proline
16. glycine-leucine-threonine to glycine-stop
17. A frameshift mutation occurred. One of the G nucleotides and two C nucleotides have been deleted. The second codon is a stop codon, which will cause translation to end prematurely. The protein for that gene will be shortened and incomplete.

Gene Technology

INTERPRETING DIAGRAMS

1. The structure labeled *A* is a plasmid. It is removed from the bacterial cell so that the plasmid can be used as a vector to carry the insulin gene into a bacterial cell.
2. Restriction enzymes are used to cut DNA. DNA molecules cut with restriction enzymes have sticky ends that allow different DNA fragments cut with the same restriction enzyme to combine.
3. This is recombinant DNA. (The DNA with the insulin gene and plasmid DNA are combined).
4. This is a bacterial cell that contains recombined plasmids (plasmids containing the insulin gene).
5. CCGG and GGCC
6. pair on the left—GGCC/CCGG; pair on the right—CCGG/GGCC
7. Tetracycline, an antibiotic, destroys bacterial cells. Some bacterial cells, however, contain a gene for tetracycline resistance in their plasmid DNA, and they are not harmed by the antibiotic. These cells are called tetracycline-resistant cells. In the diagram, the plasmid DNA used in the genetic engineering experiment has the gene for tetracycline resistance. Only the cells that have taken up the plasmid DNA with the gene for tetracycline resistance survive when tetracycline is added to the cultures. Only the resistant cells, those that also carry the gene of interest, survive.