Protein Synthesis Simulation Lab

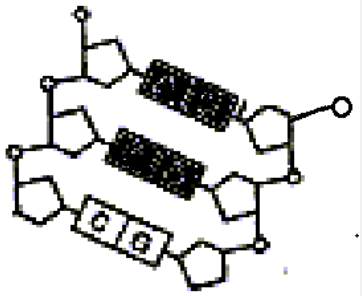
This lab was originally created by Susan Offner and is part of the Access Excellence Collection.

All credit is given to her for this original idea which I have modified for my classes.

The following is the base sequence on one strand of a DNA molecule:

T A C G C C A G T G GT T C G A T C

1. Give the base sequence of the complementary DNA strand.

2. How many nucleotides are in the short DNA sequence at the right?	

Use the original DNA strand below to answer question 3 which follows.

T A C G C C A G T G G T T C G A T C

3. Give the base sequence of the strand of mRNA read from the original DNA strand.

4. The original DNA strand serves as a template. What does the term **template** mean?

5. Draw the first three nucleotide sequences of the RNA molecule whose bases you determined in question 3. Remember that RNA is only half as large as a DNA molecule.

6. What protein fragment would the mRNA sequence you indicated in the answer for question # 3 code for? Hint: You need the chart for the genetic code for mRNA codons on the next page to do this.

Universal Genetic Code Chart

Messenger RNA Codons and Amino Acids for Which They Code

First base	Second base: U	Second base: C	Second base: A	Second base: G	Third base
U	UUU, UUC: PHE UUA, UUG: LEU	UCU, UCC, UCA, UCG: SER	UAU, UAC: TYR UAA, UAG: STOP	UGU, UGC: CYS UGA: STOP UGG: TRP	U C A G
C	CUU, CUC, CUA, CUG: LEU	CCU, CCC, CCA, CCG: PRO	CAU, CAC: HIS CAA, CAG: GLN	CGU, CGC, CGA, CGG: ARG	U C A G
A	AUU, AUC, AUA: ILE AUG: MET or START	ACU, ACC, ACA, ACG: THR	AAU, AAC: ASN AAA, AAG: LYS	AGU, AGC: SER AGA, AGG: ARG	U C A G
G	GUU, GUC, GUA, GUG: VAL	GCU, GCC, GCA, GCG: ALA	GAU, GAC: ASP GAA, GAG: GLU	GGU, GGC, GGA, GGG: GLY	U C A G

Note the new DNA strand below where a G was added to the original DNA strand after the 3rd nitrogenous base. Use this strand to answer questions 7 and 8 which follow.

T A C G G C C A G T G G T T C G A T C

7. What would the mRNA coding from this new DNA strand look like?

8. What would the resulting protein look like? (the amino acid sequence)
(Hint: you cannot have an amino acid for the last single letter)

9. How does the protein fragment you created in question 8 compare with the protein fragment you created in question 6?

Now note the new DNA strand is changed so the thirteenth base on the original DNA strand is changed from an A to a T. Use this new strand to answer questions 10 and 11 which follow.

T A C G C C A G T G G T T C G T T C

10. What would the mRNA coding from this new DNA strand look like?

11. What would the resulting protein look like?

12. What do we call changes in the base sequence of a DNA molecule?

13. How do nitrogenous base changes generally influence the protein formed from the code?

Questions for Regents Practice

Use the chart which follows and the Universal Genetic Code Chart to complete the table which follows questions 14 through 16.

14. Using the Universal Genetic Code Chart found previously in this lab, fill in the missing amino acids in the amino acid sequence for species *A* in the chart.

15. Using the information given, fill in the missing mRNA bases in the mRNA strand for species *B* in the chart.

16. Using the information given, fill in the missing DNA bases in the DNA strand for species *C* in the chart.

Species A	DNA strand:	TAC	CGA	CCT	TCA
	mRNA strand:	AUG	GCU	GGA	AGU
	Amino acid sequence:	____	____	____	____
Species B	DNA strand:	TAC	TTT	GCA	GGA
	mRNA strand:	____	____	____	____
	Amino acid sequence:	MET	LYS	ARG	PRO
Species C	DNA strand:	____	____	____	____
	mRNA strand:	AUG	UUU	UGU	CCC
	Amino acid sequence:	MET	PHE	CYS	PRO
Species D	DNA strand:	TAC	GTA	GTT	GCA
	mRNA strand:	AUG	CAU	CAA	CGU
	Amino acid sequence:	MET	HIS	GLN	ARG
Species E	DNA strand:	TAC	TTC	GCG	GGT
	mRNA strand:	AUG	AAG	CGC	CCA
	Amino acid sequence	MET	LYS	ARG	PRO

17. According to the information in the chart, which *two* species are most closely related? Support your answer

18. Given the DNA sequence TAC GCA CCT, state an example of a mutation in one base of this sequence that **WOULD NOT** change the protein it codes for.