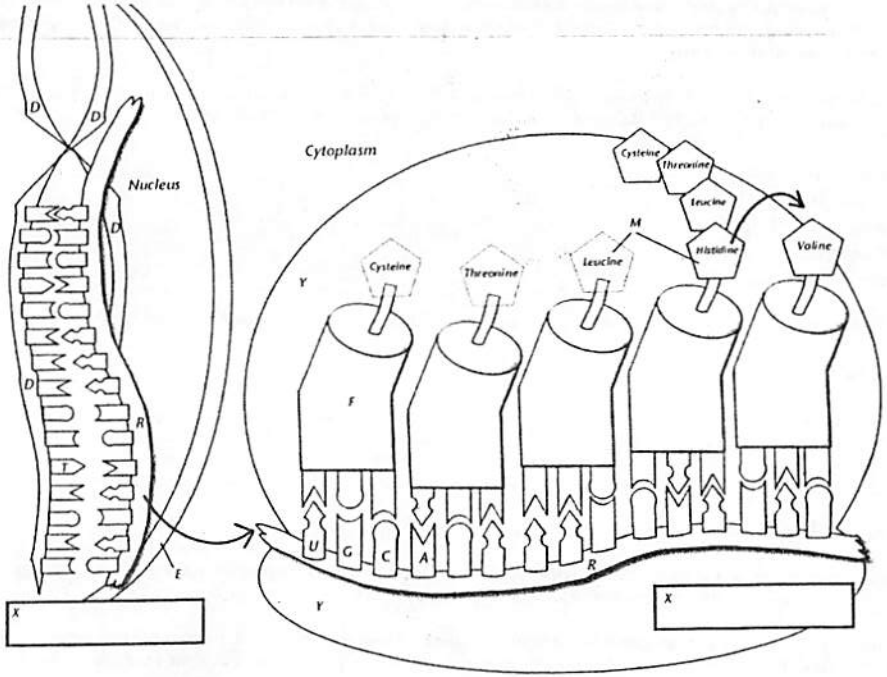
Name _____ Date _____ Period ____

DNA Coloring - Transcription & Translation



Questions:

1. How many different kinds of bases can be found on DNA _____
2. What base is found on RNA but not on DNA? _____
3. How many bases are in a codon? _____ In an anticodon? _____
4. How many amino acids are attached to a single transfer RNA? _____
5. Transcription occurs in the _____; translation occurs in the _____.
6. The process of making RNA from DNA is called _____ and it occurs in the _____
7. The process of assembling a protein from RNA is called _____ and it occurs in the _____

How DNA Controls the Workings of the Cell

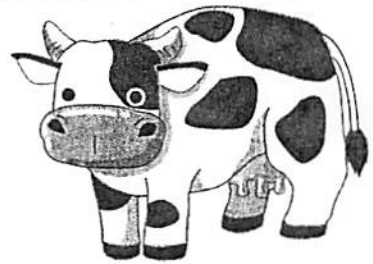
Below are two partial sequences of DNA bases (shown for only one strand of DNA) Sequence 1 is from a human and sequence 2 is from a cow. In both humans and cows, this sequence is part of a set of instructions for controlling a bodily function. In this case, the sequence contains the gene to make the protein insulin. Insulin is necessary for the uptake of sugar from the blood. Without insulin, a person cannot use digest sugars the same way others can, and they have a disease called diabetes.

	Using the DNA sequence, make a complimentary RNA strand from both the human and the cow. Write the RNA directly below the DNA strand (remember to substitute U's for T's in RNA)	*Use the codon table in your book to determine what amino acids are assembled to make the insulin protein in both the cow and the human. Write your amino acid chain directly below the RNA sequence.*
Sequence 1 – Human		
DNA : C C A T A G C A C G T T A C A A C G T G A A G G T A A		
RNA :		
Amino Acids:		
Sequence 2 – Cow		
DNA : C C G T A G C A T G T T A C A A C G C G A A G G C A C		
RNA:		
Amino Acids:		

Analysis

1. The DNA sequence is different for the cow and the human, but the amino acid chain produced by the sequence is almost the same. How can this happen?

2. Could two humans (or two cows) have some differences in the DNA sequence for insulin, yet still make exactly the same insulin proteins? Explain.



MUTATIONS

Diabetes is a disease characterized by the inability to break down sugars. Often a person with diabetes has a defective DNA sequence that codes for the making of the insulin protein. This mutation is called a **POINT MUTATION** because only one amino acid is affected.

3.. Suppose a person has a mutation in their DNA, and the first triplet for the gene coding for insulin is C C C (instead of C C A). Determine what amino acid the new DNA triplet codes for. Will this person be diabetic?

What if the first triplet was C A A ?

4. How is it that a code consisting of only four letters, as in DNA (A, T, G, C) can specify all the different parts of an organism and account for all the diversity of organisms on this planet?

A **FRAMESHIFT MUTATION** occurs when a base is added (or removed) from a DNA/RNA sequence.

5. Determine the amino acid chain coded for by the following sequence:
A C C U C A G C U C C A

Suppose a mutation occurs wher another A is added after the first codon. What would the new sequence of amino acids be?

6. DNA sequences are often used to determine relationships between organisms. DNA sequences that code for a particular gene can vary widely. Organisms that are closely related will have sequences that are similar.

Below is a list of sequences for a few organisms:

Human: CCA TAG CAC CTA	Chimpanzee: CCA TAA CAC CTA
Pig: CCA TGG AAA CGA	Cricket: CCT AAA GGG ACG

--Based on the sequences, which two organisms are most closely related?

--An unknown organism is found in the forest, and the gene is sequenced, and found to be C C A T G G A A T C G A , what kind of animal do you think this is?

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Transcription

RNA, Ribonucleic Acid is very similar to DNA. RNA normally exists as a single strand (and not the double stranded double helix of DNA). It contains the same bases, adenine, guanine and cytosine. However, there is no thymine found in RNA, instead there is a similar compound called uracil.

Transcription is the process by which RNA is made from DNA. It occurs in the nucleus. Label the box with the x in it near the nucleus with the word TRANSCRIPTION and proceed to color the bases according to the key below

Thymine = orange
Adenine = dark green
Guanine = purple
Cytosine = yellow
Uracil = brown

Color the strand of DNA dark blue (D) and the strand of RNA light blue (R). Color the nuclear membrane (E) gray.

Translation

Translation occurs in the cytoplasm, specifically on the ribosomes. The mRNA made in the nucleus travels out to the ribosome to carry the "message" of the DNA. Here at the ribosome, that massage will be translated into an amino acid sequence. Color the ribosome light green (Y) and note how the RNA strand threads through the ribosome like a tape measure and the amino acids are assembled. The RNA strand in the translation area should also be colored light blue, as it was colored in the nucleus.

Label the box with the X in the translation area with the word TRANSLATION.

Important to the process of translation is another type of RNA called Transfer RNA (F) which function to carry the amino acids to the site of protein synthesis on the ribosome. Color the tRNA red.

A tRNA has two important areas. The anticodon, which matches the codon on the RNA strand. Remember that codons are sets of three bases that code for a single amino acid. Make sure you color the bases of the anticodon the same color as the bases on your DNA and RNA strand - they are the same molecules!

At the top of the tRNA is the amino acids There are twenty amino acids that can combine together to form proteins of all kinds, these are the proteins that are used in life processes. When you digest your food for instance, you are using enzymes that were originally proteins that were assembled from amino acids. Each tRNA has a different amino acid which link together like box cars on a train. Color all the amino acids (M) pink.