

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.

<i>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)</i>	<i>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.</i>
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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 their DNA sequence and 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 when 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?