

# Nucleotide triplets:

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NA QUESTION 1982: L. PETERSON/AP BIOLOGY A portion of a specific DNA molecule consists of the following sequence of nucleotide triplets: TAC GAA CTT CGG TCC This DNA sequence codes for the following short polypeptide: methionine - leucine - glutamic acid - proline - arginine Describe the steps in the synthesis of this polypeptide. What would be the effect of a deletion or an addition in one of the DNA nucleotides? What would be the effect of a substitution in one of the nucleotides? STANDARDS: In the transcription phase of protein synthesis, students were given a point for a correct definition of transcription. They were awarded one point for mentioning each of the following: \_\_ DNA as the template molecule for messenger RNA \_\_ The proper base pairing (including the uracil substitution) \_\_ The chemical characteristics of nucleotides \_\_ A comparison of RNA and DNA (other than uracil substitution) \_\_ The triplet arrangement of codons and/or anticodons \_\_ The control of transcription (Operon, etc.) \_\_ Promoters \_\_ The role of polymerase \_\_ Intervening sequences in eukaryotic cells \_\_ Factors involved in the release of mRNA from DNA \_\_ 5' - 3' arrangement with attachment at -OH end A definition of translation was worth an additional point with one point given for mention of each of the following: \_\_ Movement of mRNA from nucleus to ribosome \_\_ Association of mRNA with the ribosome and ribosomal RNA \_\_ Location of ribosomes \_\_ Description of ribosome/polyribosome structure \_\_ Role of transfer RNA in transporting amino acids \_\_ Specific characteristics of tRNA \_\_ Amino acid-tRNA complex activation \_\_ Role of ATP and enzymes \_\_ tRNA initiator molecules (met or f-met) \_\_ Initiation factors (GTP, etc.) resulting in union of 30s and 50s \_\_ Bonding of tRNA to 50s (A site) \_\_ Role of amino transferase \_\_ Initiation

codons \_\_ Examples of initiator codons (AUG, GUG) \_\_ mRNA codon exposed at A site \_\_ Peptide bond formation (dehydration synthesis) between amino acids \_\_ Translocation of ribosome (shift from A to P site) \_\_ Termination (nonsense) codons \_\_ Examples of termination codons (UGA, UAA) \_\_ Factors that function in the release of the polypeptide A maximum of twelve points could be earned from this part of the question. In order for a student to score fifteen points, three or more points must have been from the discussion of changes in the code. A student was given one point for recognizing that an addition or deletion may alter a large portion of the resulting polypeptide. An additional point was given for explaining the importance of where the deletion or addition occurred, and another point for demonstrating knowledge of the frame shift concept. Mentioning the role of repair DNA was worth another point. A student who explained that a substitution of a nucleotide alters only one amino acid was given a point. Additional points could be earned by stating that, in some cases, the polypeptide may not be altered, that the position of the nucleotide substituted is important ("wobble" effect) and that these changes in the code are important to natural selection and evolution.