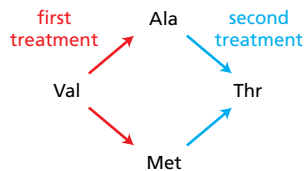


Think about the following problems and discuss them in pairs

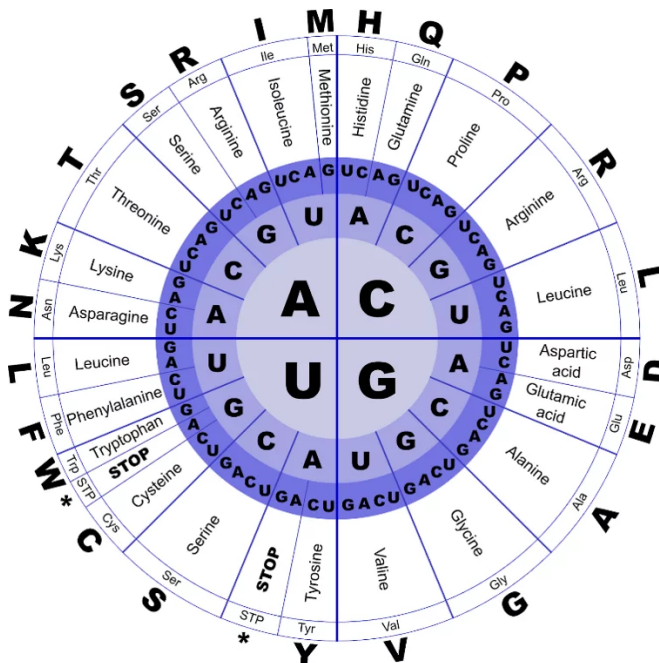
After treating cells with a chemical mutagen, you isolate two mutants. One carries alanine and the other carries methionine at a site in the protein that normally contains valine. After treating these two mutants again with the mutagen, you isolate mutants from each that now carry threonine at the site of the original valine. Assuming that all mutations involve single-nucleotide changes, deduce the codons that are used for valine, methionine, threonine, and alanine at the affected site. Would you expect to be able to isolate valine- to-threonine mutants in one step?



Which of the following mutational changes would you predict to be the most deleterious to gene function? Explain your answers.

1. Insertion of a single nucleotide near the end of the coding sequence.
2. Removal of a single nucleotide near the beginning of the coding sequence.
3. Deletion of three consecutive nucleotides in the middle of the coding sequence.
4. Substitution of one nucleotide for another in the middle of the coding sequence.

### Multiple Choice Questions



1. Which statements are not true for the RNA splicing process:
  - a. The splicing machinery recognises three sequences located within the introns of the pre-mRNA.
  - b. The removed part of the pre-mRNA forms a secondary structure.

- c. Each snRNP binds to specific part of pre-mRNA and not all snRNPs bind at the same time.
  - d. RNA splicing process depends only on the function of snRNPs and not on proteins.
2. Which statements are true for tRNA:
  - a. tRNAs form a secondary structure resembling cloverleaf and consists only of four major ribonucleosides.
  - b. Specific parts of tRNA molecule perform specific function.
  - c. In the synthesis of tRNA, the aminoacyl-tRNA synthetase only needs to recognize the anticodon of tRNA to ensure the proper specificity.
  - d. When isolating tRNA carrying amino acid Leu at its 3' end, one can immediately know what is the sequence of anticodon region in this tRNA.
3. Which statements are true:
  - a. During translation, the binding of tRNA anticodon to all mRNA codons is equally accurate.
  - b. There are 64 possible combinations for codons (4 x 4 x 4), but only 20 different types of amino acids, which means that most of the nucleotide triplets are never used.
  - c. The following mRNA 5'-UUGGAUGCGCCAUAUUUGCUAUA-3' can translate to Met-Arg-His-Asn-Leu-Leu-STOP
  - d. Simple tripeptide segment Leu-Met-Tyr can be coded with 12 possible mRNA sequences.
  - e. Base sequence of mRNA can be predicted from the amino acid sequence of the polypeptide product.
4. What is true for the following mRNA sequence: 5' – AUGUACUGA – 3'
  - a. Corresponding tRNA anticodons when the reading frame is AUG-UAC-UGA are the following:  
5'-CAU-3', 5'-GUA-3', 5'-UCA-3'
  - b. Amino-acid sequence for this part is (reading frame is AUG-UAC-UGA): His – Val – Ser
  - c. When the translation starts the codon 5'-AUG-3' is located at the P site and the 5'-UAC-3' on the A site.
  - d. The last codon will bind release factors at the A site instead of tRNA.
  - e. The different tRNAs needed to synthesise this particular amino acid chain are bound by the same factors during protein synthesis.
5. Which of the following statements are true:
  - a. Proteins with exposed hydrophobic surfaces are always eliminated with the protein degradation.
  - b. Refolding by the help of chaperones is a process that consumes energy.
  - c. Hsp60 detects hydrophobic amino acids on a growing peptide chain.

- d. Proper folding of the protein does not only depend on its amino acid sequence
6. Which of the following statements are true:
- a. The protein activity solely depends on its amino acids sequence.
  - b. Proteasome only acts on incompletely folded proteins.
  - c. Ubiquitin marks are also used for many other purposes in cells.
  - d. Failure to execute refolding by chaperons and degradation by proteasome could result in nonspecific aggregation of hydrophobic regions.
7. What is true for the following mRNA:
- 5' – AUGGGUCGUGAGUCAUCGUAAUUGUAGCUGGAGGGGAGGAAUGA – 3'**
- a. Only one peptide can be made from the given mRNA.
  - b. One of the amino acid sequences is: Met-Gly-Arg-Glu-Ser-Ser-Leu-Ile-Val-Ala-Gly-Gly-Glu-Glu-STOP.
  - c. 15 tRNAs are needed to assemble this peptide.
  - d. This mRNA is polycistronic.

TRUE or FALSE

- 1. A single pre-mRNA can be processed to produce two or more different mRNA molecules
- 2. Amino acids and proteins are the only macromolecules used as building blocks for ribosomes
- 3. Anticodons UUA, CUA, UCA cannot be found in tRNA.
- 4. During the protein synthesis the tRNA linked to the newly synthesized amino acid chain moves from A site to the P site
- 5. Nonsense-mediated mRNA decay eliminates broken and damaged mRNAs.
- 6. Side chains of Phenylalanine, Tryptophan and Tyrosine are usually found buried in the hydrophobic code.
- 7. Misfolded proteins enter proteasome in a 3D structure.