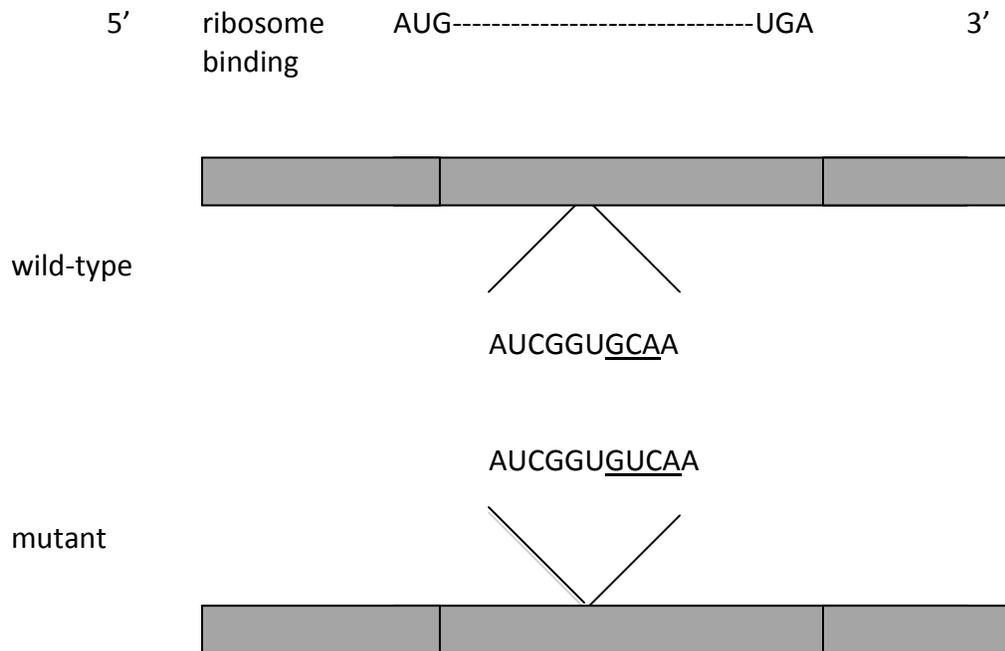


Training Question 1. Shown below is a schematic representation of an mRNA encoding a protein. The sequence of a portion of the wild type message is shown, and also the message produced by the gene following the occurrence of the point mutation displayed by underlining:



a) Circle the term(s) that describe(s) the nature of the mutation:

- i Frame shift
- ii Deletion
- iii Insertion
- iv Missense
- v Nonsense
- vi. Silent

b) Predict the likely effect, if any, the mutation will have on the function of the polypeptide encoded by this gene. Explain your reasoning in the space provided below:



Scoring rubric for Question 1:

Assigned Core Concept: # 3: *INFORMATION STORAGE AND FLOW ARE DYNAMIC & INTERACTIVE*

Core Concept Learning Objective(s): *1b. Given a list of changes in a particular DNA sequence, students should be able to **predict** how the protein sequence will be affected.*

Bloom's level: a) Level 2 comprehension
b) Level 3 application

High proficiency (3)

- a) Answer circled both: i. Frameshift and iii. Insertion and no other options.
- b) Answer clearly stated that the mutation will likely lead to a non-functional protein; will indicate that the amino acid sequence from the point of mutation onward will be different from the protein in the wild type sequence. The answer predicted that such a large scale change in sequence will likely compromise function.

Some proficiency (2)

- a) Answer circled i. Frameshift, and iii. Insertion plus one additional item, or circled only one of i. Frameshift or iii. Insertion).
- b) 1. Answer stated that the mutation will lead to multiple changes in amino acid sequence, but failed to specify how or where. The answer predicted that large scale changes in sequence will compromise function (i.e. non-functional protein or inactive protein or degraded protein)
OR
2. Answer clearly stated that because of the mutation the amino acid sequence from the point of mutation onward will be different from the protein in the wild type sequence, but assumed that function = catalysis.
OR
3. Answer clearly stated that because of the mutation the amino acid sequence from the point of mutation onward will be different from the protein in the wild type sequence, but failed to discuss effect on function.

Note: if an answer indicated that the protein might be functional or misfolded and clearly states that this is only if the mutation occurs near the C-terminal end, such an answer can be part of a proficient or highly proficient answer.

Not yet proficient (1)

- a) Answer circled only one of i. Frameshift, or iii. Insertion, plus one incorrect option.
- b) 1. Answer predicted that protein will be misfolded or truncated
OR
2. Answer only vaguely described how the mutation will impact amino acid sequence or assumed that the mutation results in a discrete amino acid substitution (point mutation) or premature termination (a possible but not exclusive outcome).

Answer not applicable (0)

a) 1. Answer left blank

OR

2. Answer circled only incorrect options.

b) 1. Answer left blank

Or

2. Answer failed to describe how amino acid sequence is affected by change in mRNA

OR

3. Answer not relevant to question