Code Cracking

Mutation Practice: Teacher Answer Key

Review:
Three of the most common types of mutations are:

1. **POINT MUTATION** (one base is substituted for another)

   If a point mutation changes the amino acid, it's called a MISSENSE mutation.
   If a point mutation does not change the amino acid, it's called a SILENT mutation.
   If a point mutation changes the amino acid to a "stop," it's called a NONSENSE mutation.

2. **INSERTION** (an extra base, or bases, is inserted)

3. **DELETION** (a base, or bases, is lost)

Deletion and insertion may cause what's called a **FRAMESHIFT**, meaning the reading frame changes. These are typically one of the most serious types of mutations.

Directions:
1. Following the same procedure you followed during the decoding activity (DNA to mRNA to Amino Acid), decode the original and mutated sequences and identify them as one of the three types of mutations listed above. If it is a point mutations, include whether it is a missense, silent, or nonsense mutations.

   The original DNA sequence is:

   DNA: TGC GTG CTT AAG CGG TGT ACA CGT TGC

   mRNA: ACG CAC GAA UUC GCC ACA UGU GCA ACG

   Amino acid: Thr His Glu Phe Ala Thr Cys Ala Thr

   Symbol: The fat cat

Now decode the following mutated sequences:

2. **TGC GTG CTT AAG CGA TGT ACA CGT TGC**
    The fat cat

    What kind of mutation is this? Point mutation, silent.

    Do you think it will affect the protein's function? Why? No. The amino acid and thus the protein sequence is unchanged.

3. **TGC GTG CTT AAG CGG TGT GCA CGT TGC**
    The fat rat

    What kind of mutation is this? Point mutation, missense

    Do you think it will affect the protein's function? Why? Unable to predict. The amino acid and protein are changed. The protein may or may not be functional.

4. **TGC GTG CTT AAG TAG TGT ACA CGT TGC**
    The fit cat

    What kind of mutation is this? Point mutation, missense.

    Do you think it will affect the protein's function? Why? Unable to predict. The amino acid and protein are changed. The protein may or may not be functional.

5. **TGC GTG CTT ACT CGG TGT GCA CGT TGC**
    Rtn sph vq

    What kind of mutation is this? Deletion, frameshift.

    Do you think it will affect the protein's function? Why? Yes. The reading frame was changed, and the protein is non-functional

6. **GCG TGC TTA AGC GGT GTA CAC GTT GC**
    The flat cat

    What kind of mutation is this? Insertion, frameshift, missense.

    Do you think it will affect the protein's function? Why? Unable to predict. Because the insertion was 3 base pairs, an extra amino acid was added and the protein may still be functional.

Extension Questions:

7. Do any of the amino acids only have one codon? Which ones?
   Yes. Tryptophan and Methionine only have one codon.

8. Many of the amino acids have more than one codon. Do you think this is an advantage or disadvantage? Why?

   This is an advantage to the organism because if there is a mistake during translation via a mutation, there is a higher chance that the altered codon will still code for the same amino acid. Note that the **redundant** codons are usually different at the third base.

9. If your DNA sequence is 96 bases long. How long will the resulting amino acid sequence be?

   96/3 = 32 amino acids

10. If a mutation doesn't cause any change to the resulting protein, what type of mutation do you think this most likely is?

    Although there are other possibilities, the most likely mutation would be a silent point mutation where a single base is changed, but the changed codon still codes for the same amino acid.