

Name _____ Date _____ Period _____

Mutations Worksheet (Answers)

There are several types of mutation:

DELETION (a base is lost)

INSERTION (an extra base is inserted)

Deletion and insertion may cause what's called a **FRAMESHIFT**, meaning the reading "frame" changes, changing the amino acid sequence.

SUBSTITUTION (one base is substituted for another)

➔ Complete the boxes below. Classify each as either Deletion, Insertion, or Substitution

Original DNA Sequence: T A C A C C T T G G C G A C G A C T

Matching DNA Sequence: A T G T G G A A C C G C T G C T G A

Mutated DNA Sequence #1: T A C A T C T T G G C G A C G A C T

What's the matching DNA Sequence? A T G T A G A A C C G C T G C T G A (circle the change)

What kind of mutation is this? SUBSTITUTION (C→G)

Mutated DNA Sequence #2: T A C G A C C T T G G C G A C G A C T

What's the matching DNA Sequence? A T G C T G G A A C C G C T G C T G A (Circle the change)

What kind of mutation is this? INSERTION (G)

Mutated DNA Sequence #3: T A C A C C T T A G C G A C G A C T

What's the matching DNA Sequence? A T G T G G A A T C G C T G C T G A (Circle the change)

What kind of mutation is this? SUBSTITUTION (G→A)

Mutated DNA Sequence #4: T A C A C C T T G G C G A C T A C T

What's the matching DNA Sequence? A T G T G G A A C C G C T G A T G A (Circle the change)

What kind of mutation is this? SUBSTITUTION (G→T)

Mutated DNA Sequence #5: T A C A C C T T G G G A C G A C T

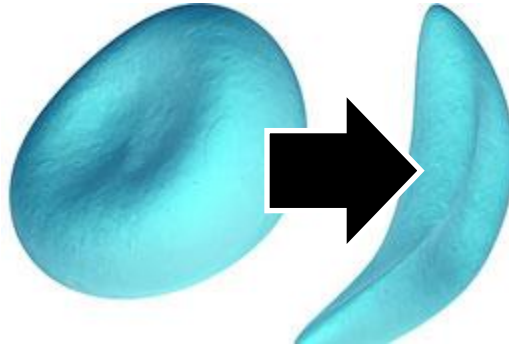
What's the matching DNA Sequence? A T G T G G A A C C C T G C T G A (Circle the change)

What kind of mutation is this? DELETION

1. Which type of mutation is responsible elongating a DNA strand? INSERTION
2. Which type of mutation results in shortening of a DNA strand? DELETION
3. Which type of mutation doesn't change the length of a DNA strand? SUBSTITUTION

Sickle Cell Anemia

Sickle cell anemia is the result of a type of mutation in the gene that codes for part of the red blood cell. Recall that red blood cells carries oxygen in your red bloods cells. The mutation causes the red blood cells to become stiff and sickle-shaped when they release their oxygen. The sickled cells tend to get stuck in blood vessels, causing pain and increased risk of stroke, blindness, damage to the heart and lungs, and other conditions.



Analyze the DNA strands below to determine what amino acid is changed and what type of mutation occurred.

Normal red blood cell DNA

C A C G T G G A C T G A G G A C T C C T C

Normal matching DNA strand

G T G C A C C T G A C T C C T G A G G A G

Sickle cell matching DNA strand

G T G C A C C T G A C T C C T G T G G A G

Sickle cell red blood cell DNA

C A C G T G G A C T G A G G A C A C C T C

What kind of mutation is this? SUBSTITUTION

Gene and Chromosome Mutation Worksheet

(reference pgs. 239-240 in *Modern Biology* textbook)

1. There are several types of gene mutations. List two. What do they have in common? How are they different?

Point mutations - alter a single base

- **base substitution mutations** – substitute one base for another
- **nonsense mutations** – create stop codon
- **frameshift mutations** – caused by insertion or deletion of a single base

-triplet repeat expansion mutations
involve a sequence of 3 DNA nucleotides that are repeated many times

Chromosomal mutations change the structure of a chromosome

- **deletions** – part of chromosome is lost
- **duplication** – part of chromosome is copied
- **inversion** – part of chromosome in reverse order
- **translocation** – part of chromosome is moved to a new location

2. A geneticist found that a particular mutation had no effect on the protein coded by a gene. What do you think is the most likely type of mutation in this gene? Why?

Substitution – silent mutation.

If there was no effect on the protein coded by the gene, then the amino acid sequence must have been the same as the original sequence. Therefore the mutation must have been a substitution resulting in a codon that encoded the same amino acid as the original amino acid.

3. Name one amino acid that has more than one codon. Name an amino acid that has only one codon

Methionine and Tryptophan have only one codon. All other amino acids have more than one codon.

4. Look at the following sequence: THE FAT CAT ATE THE RAT. Delete the first H and regroup the letters in groups of three- write out the new groups of three. Does the sentence still make sense? What type of mutation is this an example of?

TEF ATC ATE TET HER AT

This sentence no longer makes sense. This is an example of a deletion resulting in a frame shift.

5. You have a DNA sequence that codes for a protein and is 105 nucleotides long. A frameshift mutation occurs at the 85th base- how many amino acids will be correct in this protein?

The first 28 amino acids will be correct.

6. Given the following three mRNA sequences, TWO code for the same protein. Which two?

#1. AGU UUA GCA ACG AGA UCA

#2 UCG CUA GCG ACC AGU UCA

#3 AGC CUC GCC ACU CGU AGU

1 and # 3 have the same amino acid sequence, therefore they code for the same protein

7. What kind of mutation is *more likely* to result in a nonfunctional protein, a **frameshift** (resulting from an insertion or deletion) or a **point mutation**?

A frameshift mutation is more likely to result in a nonfunctional protein.

Why?

A frame shift mutation results from an insertion or a deletion, alters the sequence of bases in codons at the mutation and after the mutation. This changes the amino acid sequence and the resulting protein.

A point mutation could be a silent mutation, maintaining the original amino acid sequence and the resulting protein.