

Genetic Mutations POGIL

What mistakes can occur when DNA is replicated?

Why?

The genes encoded in your DNA result in the production of proteins that perform specific functions within your cells. Various environmental factors and spontaneous events can lead to changes in genes. These changes, called **mutations**, can lead to alterations in the structure and activity of the proteins your cells use in their daily activities. In other words, changes to your genotype can result in changes to your phenotype. We all have mutations in most of our body cells—yet we are, for the most part, normal and functional human beings. How can that be?

Model 1 – Gene Mutations

Sequence 1 (normal)

DNA sequence	... T A C G T A G T C A C C T A A T G G A T C...
mRNA sequence	A U G C A U C A G U G G A U U A C C U A G
Amino acid sequence	Met His Gln Trp Ile Thr stop

Sequence 2 (substitution)

DNA sequence	... T A C G T A G T C A G C T A A T G G A T C...
mRNA sequence	A U G C A U C A G U C G A U U A C C U A G
Amino acid sequence	Met His Gln Ser Ile Thr stop

Sequence 3 (insertion)

DNA sequence	... T A C G T A T G T C A C C T A A T G G A T C...
mRNA sequence	A U G C A U A C A G U G G A U U A C C U A G...
Amino acid sequence	Met His Thr Val Asp Tyr Leu...

Sequence 4 (deletion)

DNA sequence	... T A C G T A G T C C C T A A T G G A T C...
mRNA sequence	A U G C A U C A G G G A U U A C C U A G...
Amino acid sequence	Met His Gln Gly Leu Pro...

1. How many codons are contained in the mRNA that is produced by the “normal” DNA in Model 1?
2. How many amino acids will be in the polypeptide produced by the normal DNA/mRNA sequence?
3. Consider DNA sequence 2 in Model 1. The mutation in that sequence is a **substitution** mutation.
 - a. Compare sequence 2 with sequence 1 and describe the mutation that has occurred.
 - b. What is the effect of this substitution mutation on the amino acid sequence?
4. Consider DNA sequence 3 in Model 1. The mutation in that sequence is an **insertion** mutation.
 - a. Compare sequence 3 with sequence 1 and describe the mutation that has occurred.
 - b. What is the effect of the insertion mutation on the amino acid sequence as compared to the “normal” amino acid sequence in Model 1?

5. Consider DNA sequence 4 in Model 1. The mutation in that sequence is a **deletion** mutation.
- Compare sequence 4 with sequence 1 and describe the mutation that has occurred.
 - What is the effect of the deletion mutation on the amino acid sequence as it is compared to the “normal” amino acid sequence in Model 1?
6. Define each of the following mutations. Give an example
- Substitution mutation—
- Insertion mutation—
- Deletion mutation—
7. Considering your knowledge of codons and how they code for an amino acid, would all substitution mutations lead to a change in the amino acid sequence? Explain your reasoning.
8. Would all insertion or deletion mutations lead to a change in the amino acid sequence? Explain your reasoning.
9. What could potentially cause more damage (or a greater benefit) to an organism, a substitution mutation or an insertion mutation? Explain your reasoning.
10. What could potentially cause more damage (or a greater benefit) to an organism, a deletion mutation at the beginning of a DNA sequence or at the end of a DNA sequence? Why?