KEY CONCEPT
Mutations are changes in DNA that may or may not affect phenotype.

VOCABULARY
<table>
<thead>
<tr>
<th>mutation</th>
<th>frameshift mutation</th>
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<tbody>
<tr>
<td>point mutation</td>
<td>mutagen</td>
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MAIN IDEA: Some mutations affect a single gene, while others affect an entire chromosome.

1. List two types of gene mutations.

2. List two types of chromosomal mutations.

3. Which type of mutation affects more genes, a gene mutation or a chromosomal mutation?

4. What leads to gene duplication?

5. What is a translocation?

Below is a string of nucleotides. (1) Use brackets to indicate the reading frame of the nucleotide sequence. (2) Copy the nucleotide sequence into the first box and make a point mutation. Circle the mutation. (3) Copy the nucleotide sequence into the second box and make a frameshift mutation. Use brackets to indicate how the reading frame would be altered by the mutation.

AGGCGTCCATGA

6.

7.
MAIN IDEA: Mutations may or may not affect phenotype.
Fill in the cause-and-effect diagram below to explain how a point mutation may or may not affect phenotype.

13. For a mutation to be passed to offspring, in what type of cell must it occur?

MAIN IDEA: Mutations can be caused by several factors.
14. Can DNA polymerase catch and correct every replication error?

15. What is a mutagen?

16. How does UV light damage the DNA strand?

Vocabulary Check
17. What is a mutation?

18. If a nucleotide is deleted from a strand of DNA, what type of mutation has occurred?
MUTATIONS

Power Notes

Gene Mutations:
- 
- 

Chromosomal Mutations:
- 
- 

Mutations

Potential impact:

Silent:

Mutagens:
KEY CONCEPT Mutations are changes in DNA that may or may not affect phenotype.

A mutation is a change in an organism’s DNA. Although a cell has mechanisms to deal with mutations, exposure to mutagens may cause mutations to happen more quickly than the body can repair them. Mutagens are agents in the environment that can change DNA. Some occur naturally, such as UV light from the Sun. Many other mutagens are industrial chemicals.

Mutations may affect individual genes or an entire chromosome. Gene mutations include point mutations and frameshift mutations.

- A point mutation is a substitution in a single nucleotide.

- A frameshift mutation involves the insertion or deletion of a nucleotide or nucleotides. It throws off the reading frame of the codons that come after the mutation.

Chromosomal mutations include gene duplications and translocations. Gene duplication is the result of improper alignment during crossing over. It results in one chromosome having two copies of certain genes, and the other chromosome having no copies of those genes. Translocation is the movement of a piece of one chromosome to another, nonhomologous chromosome.

Mutations may or may not affect phenotype. Chromosomal mutations affect many genes and tend to have a large effect on an organism. They may also cause breaks in the middle of a gene, causing that gene to no longer function or to make a hybrid with a new function. The effect of a gene mutation can also vary widely. For example, a point mutation may occur in the third nucleotide of a codon and have no effect on the amino acid coded for. Or the mutation may occur in an intron and thus have no effect. However, the mutation might result in the incorporation of an incorrect amino acid that messes up protein folding and function. Or it might code for a premature stop codon. Even mutations that occur in noncoding regions of DNA can have significant effects if they disrupt a splice site or a DNA sequence involved in gene regulation. For a mutation to affect offspring, it must occur in an organism’s germ cells.

1. What is a mutation?

2. In a frameshift mutation, what is the “frame” that is being shifted?

3. How might a point mutation in a gene affect the resulting protein?