

Genetic Mutations

Despite all the attention to detail, sometimes a mistake is made when DNA is copied. What then?

When the sequence of nucleotides that make up our genetic library is altered, the result is a mutation.

There are two main types of mutations:

- 1) Gene mutations
- 2) Chromosomal mutation

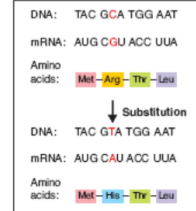
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Gene Mutations

Gene mutations are the result of a **point mutation** (a change in a single, or a few, nucleotides.)

This type of mutation can occur in two ways:

Substitution : one nucleotide is changed, resulting in a different codon, so a different amino acid, and ultimately, a different protein.



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Insertion / Deletion

: This type of gene mutation is the result of adding in, or removing a nucleotide.

These mutations can be drastic, as they result in a shift of the entire sequence of codons.

Ex: Figure 12-20, p. 307

THEFATCATATETHERAT

THE FAT CAT ATE THE RAT



TEFATCATATETHERAT

TEF ATC A TA TH ER AT



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Chromosomal Mutations

These mutations are the result of a change to the entire chromosome.

Either:

- A gene has been deleted
- A gene has been duplicated and appears more than once.
- The location of two (or more) genes have been switched
- Part of one chromosome has become detached and re-attaches itself to another chromosome.

A B C D E F
Original chromosome

A C D E F
Deletion

A B B C D E F
Duplication

A E D C B F
Inversion

A B C D J K L
G H I L D E F
Translocation

Figure 12-21, p. 308

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Why do mutations matter?

In many cases, mutations don't have any effect.

If the mutation is noticeable, it may result in a genetic disorder. This type of mutation is harmful to the organism.

Beneficial mutations result in the creation of a protein or other substance that may help the organism survive longer / better.

Mutations can typically only be inherited if they occur in gamete cells, designed to create a new organism.

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Polyploidy

Polyploidy is an example of a beneficial mutation in which an entire set of chromosomes does not separate during meiosis. This happens relatively often in plants.

The result is an organism with 3 sets of chromosomes (3N - triploid) or even 4 sets (4N - tetraploid)!

These plants are often stronger and larger than their diploid counterparts. Plant breeders have used this to their advantage for years to create many sturdy crop plants.

ex: Wheat is known to have up to 6 sets of chromosomes!!!
(6N - hexaploid)

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Polyploidy types

- **Polyploid** types are labeled according to the number of chromosome sets in the [nucleus](#).
- **triploid** (three sets; 3n), for example the [phylum](#) [Tardigrada](#)
- **tetraploid** (four sets; 4n), for example [Salmonidae](#) fish
- **pentaploid** (five sets; 5n)
- **hexaploid** (six sets; 6n), for example [wheat](#), [kiwifruit](#)
- **octaploid** (eight sets; 8n), for example [dipenser](#) (genus of [surgeon](#) fish)
- **decaploid** (ten sets; 10n), for example certain [strawberries](#)
- **dodecaploid** (twelve sets; 12n), for example the plant [Celastrum argenteum](#) and the amphibian [Xenopus ruwenzoriensis](#)

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