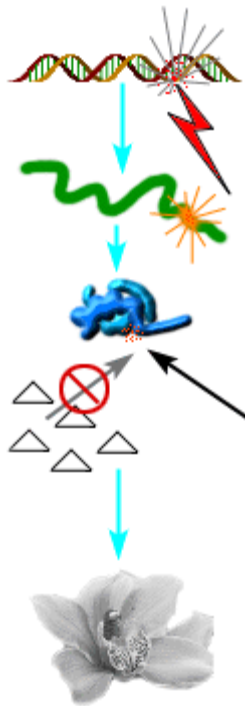




## Mutations



# Definition



A **Mutation** occurs when a DNA gene is damaged or changed in such a way as to alter the genetic message carried by that gene.

A **Mutagen** is an agent of substance that can bring about a permanent alteration to the physical composition of a DNA gene such that the genetic message is changed.

Once the gene has been damaged or changed the mRNA transcribed from that gene will now carry an altered message.

The polypeptide made by translating the altered mRNA will now contain a different sequence of amino acids. The function of the protein made by folding this polypeptide will probably be changed or lost. In this example, the enzyme that is catalyzing the production of flower color pigment has been altered in such a way it no longer catalyzes the production of the red pigment.

No product (red pigment) is produced by the altered protein.

In subtle or very obvious ways, the phenotype of the organism carrying the mutation will be changed. In this case the flower, without the pigment is no longer red.

## Mutagens

**Chemical Mutagens** change the sequence of bases in a DNA gene in a number of ways;

- mimic the correct nucleotide bases in a DNA molecule, but fail to base pair correctly during DNA replication.
- remove parts of the nucleotide (such as the amino group on adenine), again causing improper base pairing during DNA replication.
- add hydrocarbon groups to various nucleotides, also causing incorrect base pairing during DNA replication.

**Radiation** High energy radiation from a radioactive material or from X-rays is absorbed by the atoms in water molecules surrounding the DNA. This energy is transferred to the electrons which then fly away from the atom. Left behind is a **free radical**, which is a highly dangerous and highly reactive molecule that attacks the DNA molecule and alters it in many ways.

Radiation can also cause double strand breaks in the DNA molecule, which the cell's repair mechanisms cannot put right.

**Sunlight** contains ultraviolet radiation (the component that causes a suntan) which, when absorbed by the DNA causes a cross link to form between certain adjacent bases. In most normal cases the cells can repair this damage, but unrepaired **dimers** of this sort cause the replicating system to skip over the mistake leaving a gap, which is supposed to be filled in later.

Unprotected exposure to UV radiation by the human skin can cause serious damage and may lead to skin cancer and extensive skin tumors.

**Spontaneous** mutations occur without exposure to any obvious mutagenic agent. Sometimes DNA nucleotides shift without warning to a different chemical form (known as an **isomer**) which in turn will form a different series of

hydrogen bonds with it's partner. This leads to mistakes at the time of DNA replication.

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