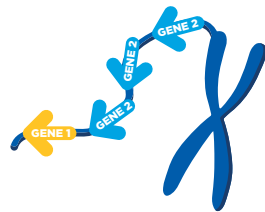

GENETIC MUTATIONS

Mutations are changes in the genetic sequence of a cell. They may be caused by errors during cell multiplication or due to exposure to DNA-damaging agents in the environment. In the case of viruses, such as SARS-CoV-2, mutations in their genetic materials arise due to errors when the viral genome is copied during viral multiplication. Viruses also acquire mutations through a process called recombination, which occurs when two different types of viruses coinfect the same host cell and exchange their genetic material during multiplication to generate new viral variants that have some genes from both parent viruses. Mutations can be harmful, beneficial, or have no effect. Mutations in human cells may lead to cancer. Among the various types of mutations that lead to cancer are:

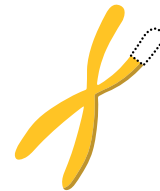
Extra copies of genes (gene amplification)

Higher quantities of certain proteins can result in enhanced cell survival and growth, leading to cancer.



Deletions

Loss of DNA can result in loss of genes necessary to regulate the processes that control normal cell growth, division, and life span, leading to cancer development.



Single base changes

Deletion or insertion of a single base can result in new proteins, altered versions of normal proteins, or loss of protein function, which can lead to cancer. Single base changes are also one of the most common causes of mutations in the SARS-CoV-2 genetic material.



Of note, cells acquire mutations over time, but not all mutations cause cancer. In addition, not all mutations found in a cancer cell drive cancer development.