



A Brief Note on Types of DNA Damage

Stepha Naris*

Department of Chemistry, University of Purnea, Purnia, Bihar, India

ARTICLE HISTORY

Received: 02-May-2022, Manuscript No. EJMOAMS-22-62411;

Editor assigned: 04-May-2022, PreQC No. EJMOAMS-22-62411 (PQ);

Reviewed: 18-May-2022, QC No. EJMOAMS-22-62411;

Revised: 23-May-2022, Manuscript No. EJMOAMS-22-62411 (R);

Published: 02-Jun-2022

Description

DNA damage, due to natural factors and normal metabolic processes within the cell, occurs at an average of 1,000 to 1,000,000 cellular lesions per cell per day. Although this includes only 0.000165% of human genes about 6 billion bases (3 billion pairs), if left unrepaired it can cause genetic mutations (such as genetically suppressing tumours) that can impair cell and appreciably increase the likelihood of tumour formation and disease states such as cancer.

Most DNA damage affects the main structure of the double helix; that is, the bases themselves are chemically modified. These changes can disrupt the normal helical formation of molecules by introducing non-native chemical bonds or large additives that do not fit into the normal double helix. Unlike proteins and RNA, DNA often lacks a tertiary structure or disruption does not occur at that level. DNA, however, is supercoiled and surrounded by "packing" proteins called histones (eukaryotes), and both major structures are vulnerable to the effects of DNA damage.

There are several types of DNA damage that may be due to normal cellular processes or due to the natural exposure of cells to harmful DNA agents. DNA bases can be damaged: (1) oxidative damage, (2) alkylation of bases, (3) base loss caused by hydrolysis of the bases, (4) bulky adduct formation, (5) DNA crosslinking, and (6) DNA strand breaks, consisting of single and double breaks.

Types

Oxidative damage: Reactive Oxygen Species (ROS) can cause severe cellular stress and damage including oxidative damage to DNA. Hydroxyl radicals ($\bullet\text{OH}$) are one of the most active and electrophilic compounds in ROS and can be produced by ultraviolet and ionizing radiation or other

radicals arising from enzymatic reactions.

Alkylation of bases: Damage to DNA alkylation can be a major threat to genetic integrity and cell life. To combat this damage, cells use incredibly large and efficient repair mechanisms, including the removal of damaged nucleotides from DNA, direct removal of the wound without further fixation of nucleotide or DNA, and protein-binding proteins. The existence of these comprehensive and innovative mechanisms for cell protection emphasizes the importance of repairing DNA alkyl lesion.

Base loss caused by the hydrolysis of bases: The covalent structure of DNA is not stable in aqueous solution. It tends to hydrolyze in its monomeric components, and they themselves are subject to various hydrolytic reactions. These processes are slower, compared to normal chemical reactions.

Bulky adduct formation: Bulk DNA adducts are signals of exposure to genotoxic aromatic compounds, which indicate human ability to activate carcinogens and repair DNA damage. Polycyclic Aromatic Hydrocarbons (PAH) represent a large group of carcinogens capable of producing such adducts.

DNA crosslinking: DNA crosslinking occurs when various foreign or endogenous agents react with two DNA nucleotides, forming a link between them. This link can occur between the same thread or between the opposing strands of DNA with two strands.

DNA Strand Breaks (DSBs): Double-Strand Breaks (DSBs) in the form of DNA due to exposure to external agents such as radiation and certain chemicals, as well as endogenous processes, which include DNA replication and repair.