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DNA damage and repair

Introduction

DNA is the repository of genetic information in each living cell, its integrity and stability are essential to life. DNA, however, is not inert; rather, it is a chemical entity subject to assault from the environment, and any resulting damage, if not repaired, will lead to mutation and possibly disease. DNA damage exists in all cellular organisms . While DNA damage is distinguished from mutation, mutation can result from unrepaired DNA. While most DNA damage can be repaired, such repair systems are not 100% efficient. Un-repaired DNA damage accumulates in non-replicating cells, such as neurons or myocytes of adult mammals, and can cause aging.

DNA damage can be subdivided into two types

: 1) endogenous damage caused by reactive oxygen species (ROS) that are derived from metabolic by product. Also includes replication error.

2) exogenous damage caused by radiation (UV, X-ray, gamma), hydrolysis, plant toxins, and viruses. Agents that Damage DNA 1- Highly reactive oxygen radicals produced during normal cellular respiration as well as by other biochemical pathways

2- Ionizing radiation such as gamma rays and x-rays

3-Ultraviolet rays, especially the UV-C rays (~260 nm) that are absorbed strongly by DNA but also the longer-wavelength UV-B that penetrates the ozone shield

4- Aromatic hydrocarbons, including some found in cigarette smoke

5-Plant and microbial products, e.g. the Aflatoxin

6- Chemicals used in chemotherapy, especially chemotherapy of cancers.

The rate of DNA repair is dependent on :

1-the cell type.

2-the age of the cell.

3-the extracellular environment .

Types of DNA damage

Single-base alteration	Depurination Insertion or deletion of nucleotide Alkylation of bas
Two-base alterations	UV light–induced thymine-thymine (pyrimidine) dime
Chain breaks	Ionizing radiation Oxidative free radical formation
Cross-linkage	Between bases in same or opposite strands Between DNA and protein molecules

DNA repair: is collection of processes by which acell identifies and corrects damage to the DNA MOLECULE THAT ENCODE ITS GENOME

TYPES OF REPAIR

1.Direct reversal

2.Excision repair

A.Mismatch repair.B.base Excision repair c.nucleotide Excision
3.Recombinational repair.

Mechanical repair

- 1.identify the location of the error.
- 2.cut or remove the error.
- 3.Add the correct .
- 4. connect.

Repair system	enzyme
Base excision	DNA glycosylase (detects and altered base and removed) AP Endonuclease(remove sugar phosphate). DNA polymerase I(fills) DNA ligase (seals)
Nucleotide Excision	Uvr_A,B,c(detects and remove) DNA polymerase I(fills) DNA Ligase(seals)
mismatch	Dam methylation(dected) Mut S,L,H(DETECT) Exonuclease (DETECT) DNA Helicase II(REMOVE) SS protein (REMOVE) DNA polymerase III (fills) DNA Ligase(seals)

TABLE (THE DNA REPAIRING OF E.Coli)

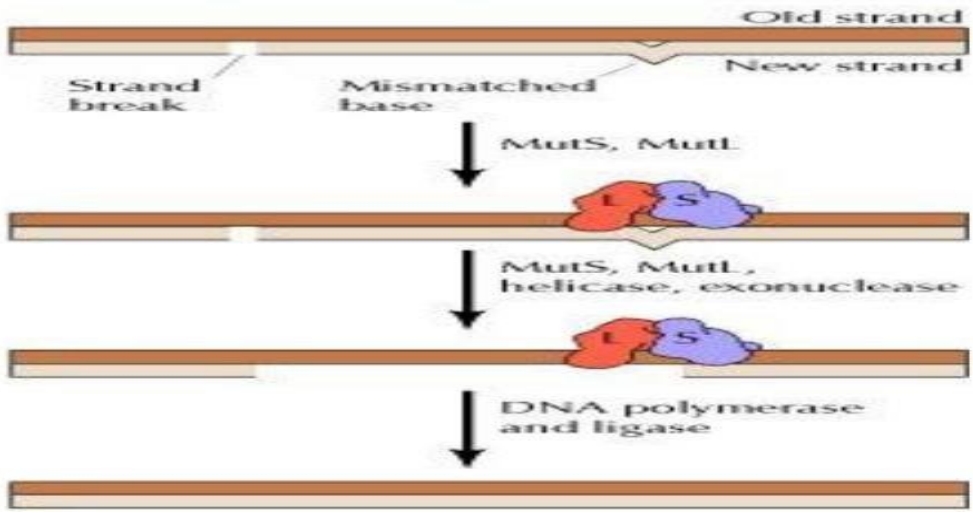

Figure (1_1)mismatch repair

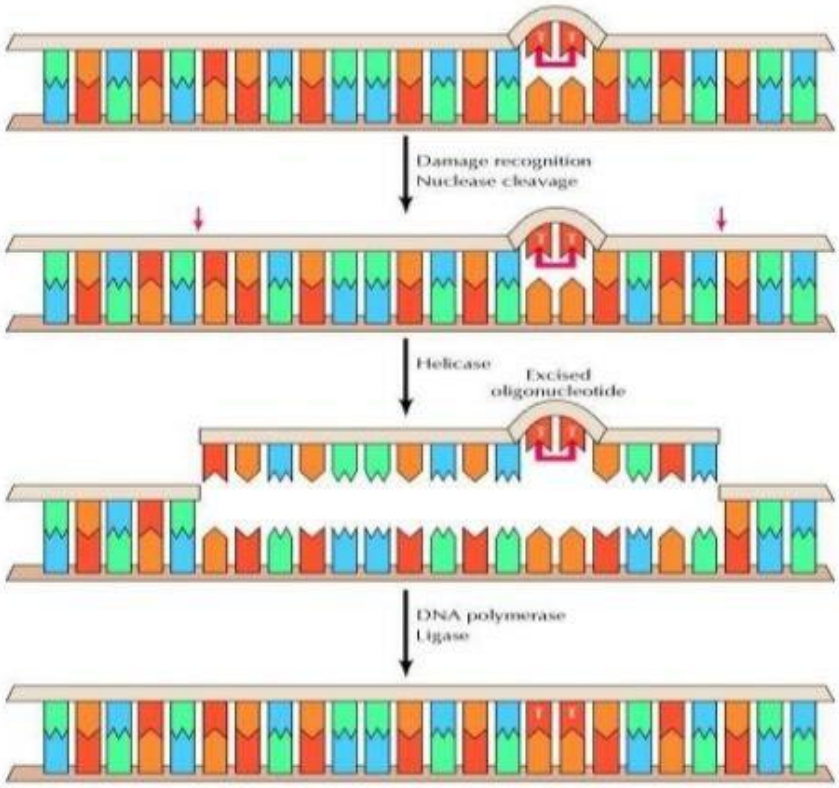

figure (1_2)nucleotide excision

حكمة الى طلبتي الاعزاء

(كلما زاد العلم زاد الحلم وسيطر التواضع على النفس وعف اللسان وخشعت الجوارح والعكس بالعكس فتأملوا ..)

دمتم بخير

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