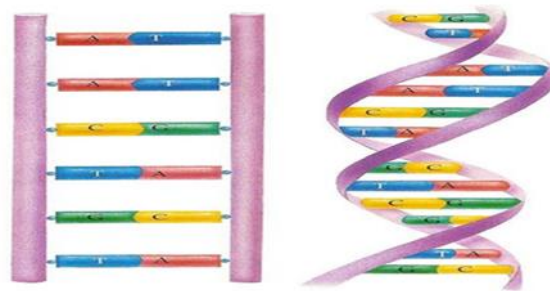


# Molecular biology and bacterial genetics

البايولوجي الجزيئي ووراثة الاحياء المجهرية

## Lec 10



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## مفردات المحاضرة العاشرة

- 1- DNA repair
- 2- DNA damage repair mechanisms
- 3- The repair mechanisms

### DNA repair

DNA repair is a collection of processes by which a cell identifies and corrects damage to the DNA molecules:

تصحيح الدنا , هو مجموعة من العمليات التي تكون داخل الخلية لتصحيح الاخطاء في جزيئة الدنا

### DNA damage repair mechanisms

ميكانيكيات تصحيح الدنا المتحطم

Mutations and damage of DNA at almost any point in a cell's lifetime, not just during replication, DNA is getting damaged all the time by outside factors like UV light, chemicals, and X-rays, cells have repair mechanisms to detect and correct many types of DNA damage.

الطفرات وتحطيم الدنا تحدث في اي فترة من عمر الخلية ليس فقط خلال التضاعف, حيث الدنا يتحطم بتأثير عوامل خارجية مثل الاشعة فوق البنفسجية, المواد الكيميائية, الاشعة السينية, الخلايا لديها نظام تصليح لتشخيص وتصحيح العديد من انواع الضرر في الدنا

## **The repair mechanisms:**

ميكانيكيات التصليح

1-Proofreading

2-Mismatch repair

3-Base excision repair

4-Nucleotide excision repair

5-Double-stranded break repair

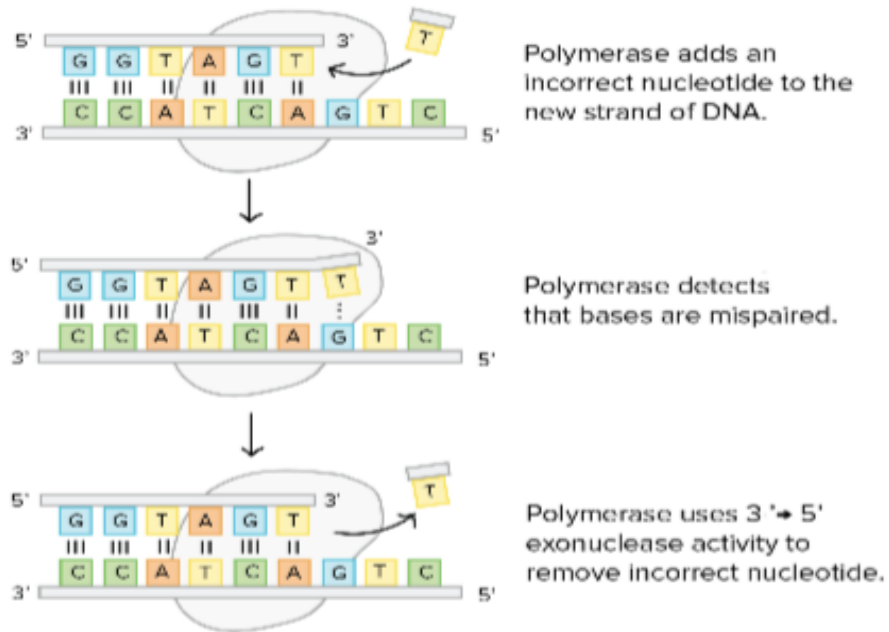
### **1-Proofreading**

تصحيح القراءة

It is the process of repairing during DNA replication (copying), in which most DNA polymerases can “check their work” with each base that they add. This process is called proofreading. If the polymerase detects that a wrong (incorrectly paired) nucleotide has been added, it will remove and replace the nucleotide right away, before continuing with DNA synthesis.

هي عملية التصليح التي تتم خلال عملية تضاعف الدنا, حيث ان اغلب انزيمات البوليميريز تقوم بهذا العمل مع كل قاعدة تتم اضافتها, فتسمى هذه العملية بتصحيح القراءة

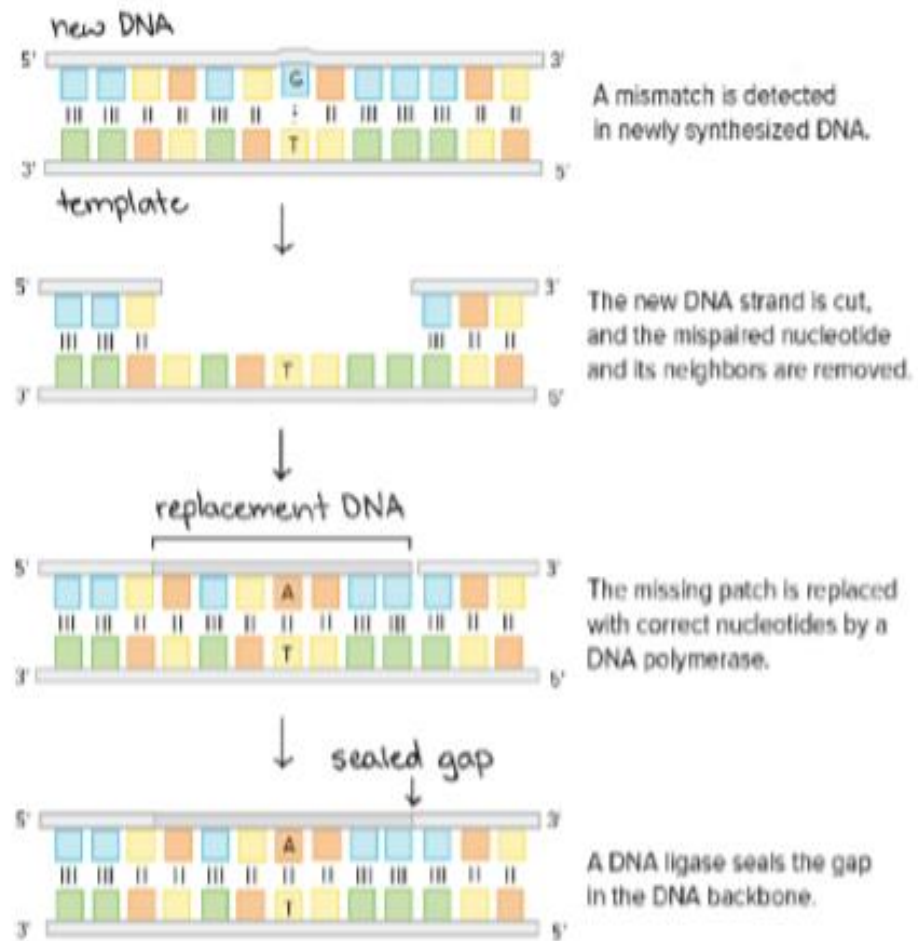
حيث اذا انزيم البوليميريز حدد او شخص خطأ (قواعد غير صحيحة) تتم اضافتها, تزال هذه القواعد ويتم اضافة القاعدة الصحيحة, قبل الاستمرار ببناء بقية الشريط



## 2-Mismatch repair

Many errors are corrected by proofreading, but a few slip through. Mismatch repair happens right after new DNA has been made, and its job is to remove and replace mis-paired bases (ones that were not fixed during proofreading).

العديد من الأخطاء تتم تصليحها بواسطة عملية تصحيح القراءة ولكن هناك أخطاء لا يتم تمييزها لذلك تصليح الدنا الغير متطابق يحدث بعدما يتكون الشريط الجديد للدنا حيث يقوم بإزالة واستبدال القواعد الخاطئة التي لم تتم تصحيحها بواسطة (خطوة تصحيح القراءة)

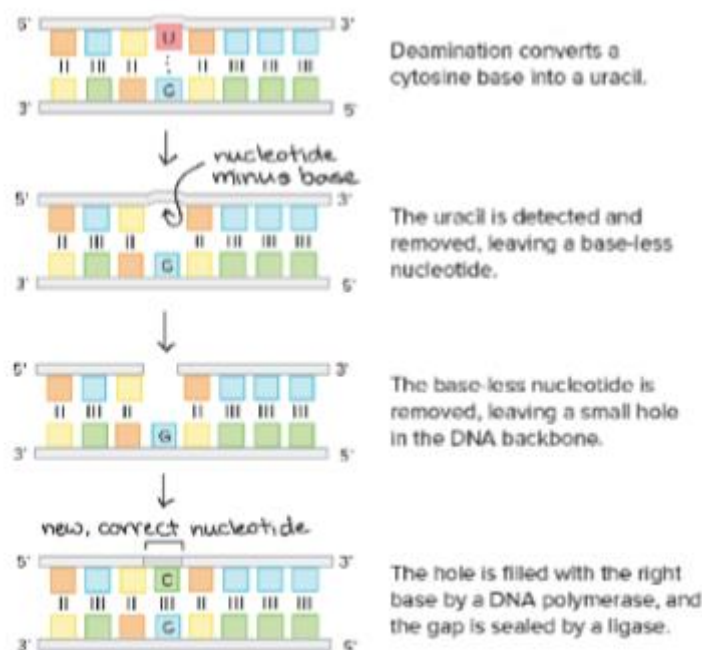


### 3-Base excision repair

تصليح استئصال القواعد

Base excision repair is a mechanism used to detect and remove certain types of damaged bases. A group of enzymes called glycosylases play a key role in base excision repair. Each glycosylase detects and removes a specific kind of damaged base. For example

هي ميكانيكة تستخدم لتشخيص واستئصال بعض انواع تلف القواعد, مجموعة من , الانزيمات تلعب دور اساسي في هذا النوع من التصليح, كل انزيم يشخص ويزيل القاعدة الخطأ,



#### **4-Nucleotide excision repair:**

Nucleotide excision repair is another pathway used to remove and replace damaged bases. Nucleotide excision repair detects and corrects types of damage that distort the DNA double helix. For instance, this pathway detects bases that have been modified with bulky chemical groups, like the ones that get attached to your DNA when it's exposed to chemicals in cigarette smoke . Nucleotide excision repair is also used to fix some types of damage caused by UV radiation, for instance, when you get a sunburn. UV radiation can make cytosine

and thymine bases react with neighboring bases that are also Cs or Ts, forming bonds that distort the double helix and cause errors in DNA replication. The most common type of linkage, a thymine dimer, consists of two thymine bases that react with each other and become chemically linked

- **DNA proofreading and repair in human disease Evidence** for the importance of proofreading and repair mechanisms comes from human genetic disorders. In many cases, mutations in genes that encode proofreading and repair proteins are associated with heredity cancers (cancers that run in families). For example:
  - ❖ Hereditary nonpolyposis colorectal cancer (also called Lynch syndrome) is caused by mutations in genes encoding certain mismatch repair protein . Since mismatched bases are not repaired in the cells of people with this syndrome, mutations accumulate much more rapidly than in the cells of an unaffected person. This can lead to the development of tumors in the colon.
  - ❖ People with xeroderma pigmentosum are extremely sensitive to UV light. This condition is caused by mutations affecting the nucleotide excision repair pathway. When this pathway doesn't work, thymine dimers and other forms of UV damage can't be repaired. People with xeroderma pigmentosum develop severe sunburns from just a few minutes in the sun, and about half will get skin cancer by the age of 10