

Lecture-8

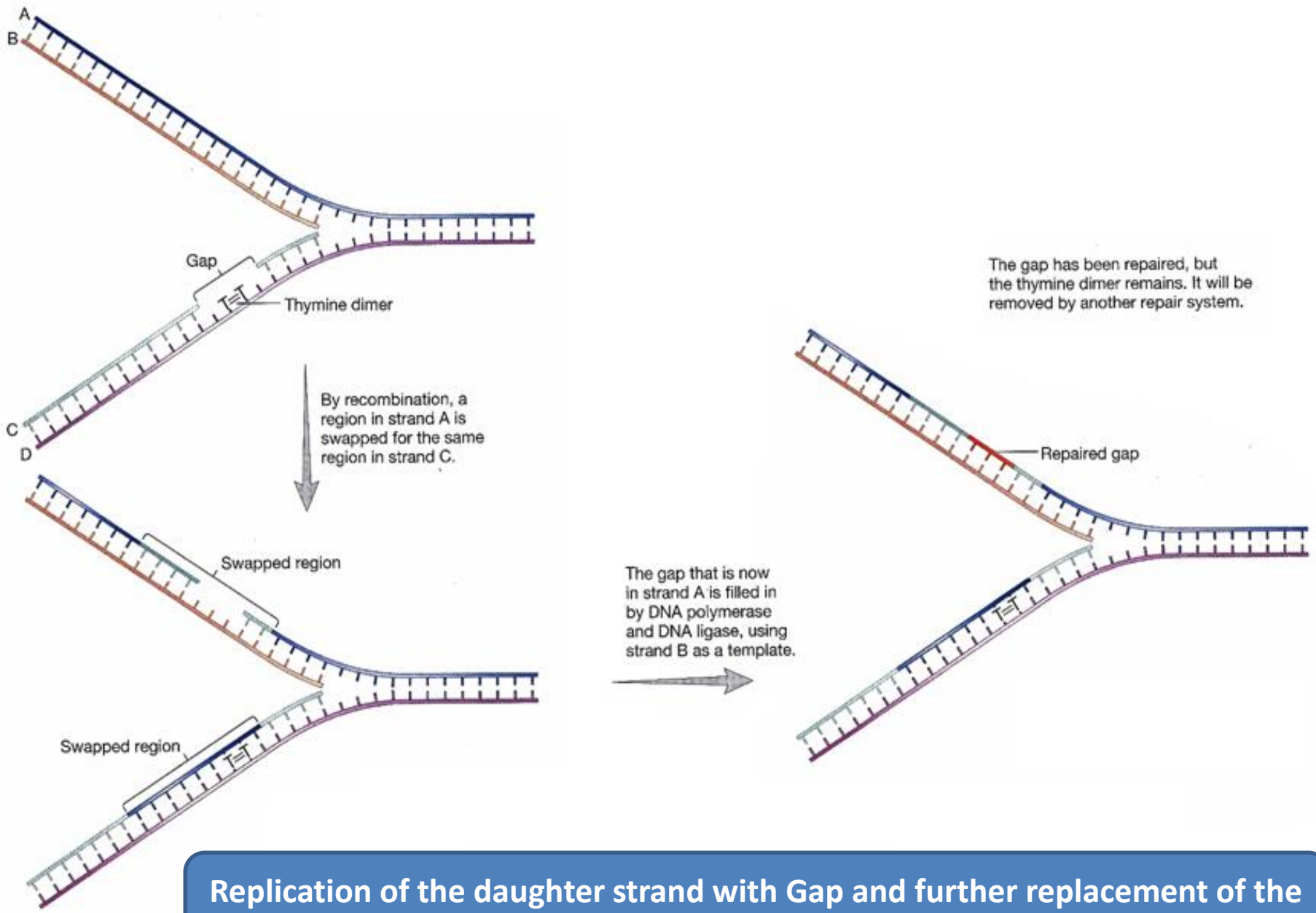
M.Sc 2nd Semester (Environmental Microbiology)

Paper EM-202: Microbial physiology and adaptation

Unit IV: DNA Recombinational Repair System

Recombination Repair

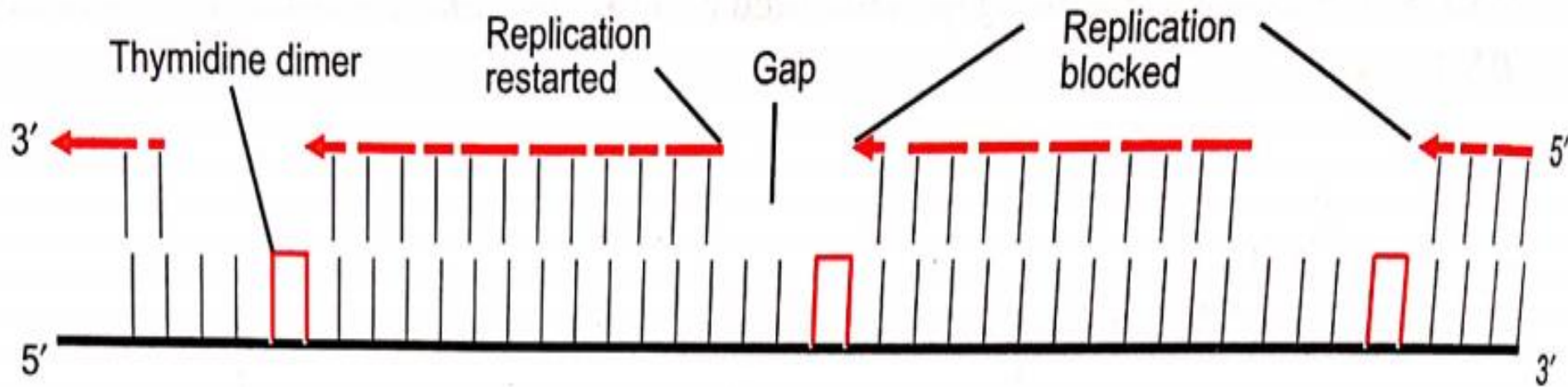
- **Recombination repair corrects damaged DNA in which both bases of a pair are missing or damaged or where there is a gap opposite a lesion. In this type of repair the Rec A protein cuts a piece of template DNA from a sister molecule and puts it into the gap or uses it to replace a damaged strand. Although prokaryotes are haploid, another copy of the damaged segment after is available because either it has recently been replicated or the cell is growing rapidly and has more than one copy of its chromosome. Once the template is in place, the remaining damage can be corrected by another repair system.**
- **Rec A is a complex protein that plays a central roles in genetic recombination and DNA repair in addition to its regulatory role. From in-vitro studies it is belived that the activated form of Rec A is a helical filament containing many Rec A molecules polymerized one single-stranded DNA and containing ATP or dATP. This filaments also plays crucial; roles in recombination and repair.**



Replication of the daughter strand with Gap and further replacement of the Gap from the parent strand

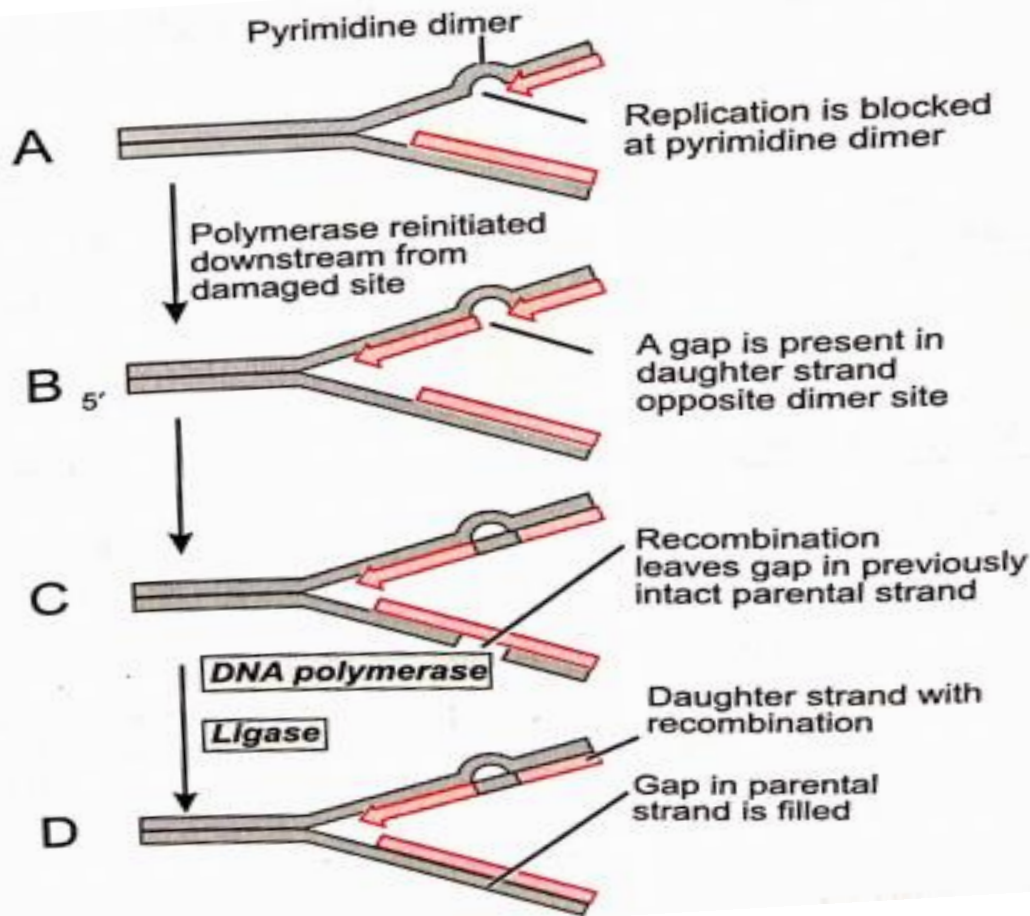
This process can be understood further as below:-

In recombinational repair the undamaged strand of parental DNA is copied during replication to produce a normal daughter molecule. During DNA replication, Polymerase III is stalled at the site of thymine dimer. The enzyme passes over the dimer block and initiates chain growth beyond the block. Therefore, the daughter strands have large gaps, one for each thymine dimer. Complete normal double-stranded DNA molecules are formed from such fragmented and kinked DNA molecules by sister-strand exchange mechanism.



Blockage of replication due to Thymine Dimers.

In single strand exchange, the gap produced in the daughter strand is filled by recombination with the undamaged parental strand. Due to this exchange, a gap is formed in the previously intact parental strand. This is filled by the action of DNA polymerase and ligase enzymes. The pyrimidine dimer is later on removed by excision repair to produce two intact normal double stranded DNA molecules.



Post-replication repair by recombination's.

- Replicating DNA molecule with a pyrimidine dimer;
- DNA polymerase by passes the dimer and starts post dimer synthesis of new strand;
- The resultant gap in the newly synthesized DNA strand is repaired by recombination with undamaged parental strand;
- Enzymes DNA polymerase and DNA ligase fill the resultant gap in the previously intact parental strand.

Extensive Damage repair By homologous Recombination:-

Homologous recombination repair mechanism is postreplicative repair process. When DNA damage includes a longer stretch of nucleotides, an alternatives pathway is found to operate. It is called Homologous recombination. DNA polymerase stops replication on reaching the damaged site in the template strand. DNA replication is resumed at the next priming site in the template strand in the form of Okazaki fragment with a new RNA primer.

The gap left in the daughter strand or newly synthesized stand may be several hundred nucleotides. This gap is then repaired by homologous DNAs recombination with the complimentary parental strand using specific recombination enzymes, Enzymes DNA polymerases and DNA ligases repair the resulting gap; in the complimentary parental strands.