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**DEPARTMENT: BIOCHEMISTRY**

**MCB ASSIGNMENT**

1. Discuss microbial variation and heredity in bacteria.

Bacterial genetics studies the mechanisms of their heritable information, their chromosomes, plasmids, transposons and phages. The genetic material in bacteria is DNA. When a bacterial cell divides, the two daughter cells are generally indistinguishable. Occasionally, a spontaneous genetic change occurs in one of the cells. This change called a mutation, is heritable and passed on to the progeny to produce a sub clone with characteristics different from the original parent. Mutations can either be point or caused by DNA rearrangement.

Bacterial variation can also occur by horizontal transfer of genetic material from one cell to another. There are three possible mechanisms for transferring traits from one cell to another;

1. Transformation: This is the uptake of naked DNA molecules and their stable maintenance.
2. Transduction: This is the packaging and transfer of bacterial DNA in viruses known as phages(bacteriophage). There are two types of transduction, generalized transduction which occurs as a result of the lytic cycle and specialized transduction which requires a temperate bacteriophage.
3. Conjugation: This is bacterial mating in which cells must be in contact.

For all three mechanisms, the transferred DNA must be stably incorporated into the genetic material of the recipient bacterium. This can occur in two ways, recombination/integration of transferred DNA into bacterial chromosomes and establishment of plasmids.

1. Explain microbial recombination.

Recombination is the process of formation of new recombinant chromosomes by combining the genetic material from the two organisms. There are two theories for how recombination works;

1. Breakage and Reunion: Here two homologous duplex of chromosomes laying in paired forms breaks between the gene loci. The broken segments rejoin crosswise and yield recombinants. This type of recombination does not require the synthesis of new DNA.
2. Breakage and Copying: One helix of paired homologous chromosome (ab and a+ b+) breaks between a and b. Segment b is replaced by a newly synthesized segment copied from b+ and attached to a section. Thus the recombinants contain ab+ and a+ b+.

There are three types of recombination;

1. General recombination: This occurs only between complimentary strands of two homologous DNA molecules.
2. Non-reciprocal recombination: This is also known as gene conversion. Here three copies of maternal allele and only one copy of paternal allele is formed by meiosis. This indicates that one of the two copies of parental allele has been altered to the maternal allele.
3. Site specific recombination: This alters the relative position of nucleotide sequences in chromosomes. The base pairing depends on protein mediated recognition of the two DNA sequences that will combine. Very long homologous sequence is not required.