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MEDICAL LABORATORY SCIENCES.

MCB 202 ASSIGNMENT.

1.Hereditary variation in bacteria results from changes in the genetic structures. In distinction from plants and animals ,bacteria are predominantly haploid organisms, they contain one genome and combine within themselves the functions of the gamete and the individual. Bacterial Variation can also occur a horizontal transfer of genetic material from one cell to another. Mutation and gene transfer work together to accelerate the rate of bacterial evolution.

 Any change in the genotype of a bacterium or its phenotype is known as variation. Genotypic variation can occur as a result of changes in the genes by way of mutation, loss or acquisition of new genetic elements. These variations are heritable. Phenotypic variations are seen temporarily when bacteria are grown under certain environmental conditions. These variations are not heritable.
**Heritable variations:**
**Mutation:** A gene will mutate spontaneously, about once in a hundred million cell divisions. Such bacteria are called mutants. Most of these mutants die, but a when a mutant can adapt itself to the environment more readily; it may emerge as a new variant. Chromosomal mutations may lead to Emergence of drug resistance in bacteria. Examples include methicillin resistance in *Staphylococcus aureus*, Multi-drug resistance in *Mycobacterium tuberculosis*.
**Transformation:** Some bacteria have ability to uptake naked DNA fragment from the surrounding environment. When such a DNA confers new property to the bacterium, it is termed transformation. Change from R form of *Streptococcus pneumoniae* to S form as demonstrated by Griffith is due to transformation.
**Conjugation:** Transfer of genetic material (usually plasmids) from one bacterium to another through the mediation of sex pili is known as conjugation. Any property that is coded on a transmissible plasmid can be transferred to a recipient bacterium. Properties such drug resistance mediated by beta-lactamases, bacteriocin production etc can be transferred by conjugation.
**Transduction:** Transfer of genetic material through mediation of bacteriophage is known as transduction. Only those strains of *Corynebacterium diphtheriae* that are infected by a beta phage are toxigenic. Change in O antigen in Salmonella (*S. anatum*->*S. newington*-> *S.minneapolis*) is because of lysogenic phage.
**Transposition:** Variations in the flagellar antigens in Salmonella are due to transposons. Similar gene rearrangements may result in antigenic variations, as in *Neisseria gonorrhoeae* and *Borrelia recurrentis*.

**Non-heritable variations:**
A variation in the phenotype of a microorganism, where the genetic constitution remains unchanged is a non-heritable variation. Such variations are seen due to a change in environmental conditions and such variations are neither permanent nor heritable. They may revert back to normal state when the conditions are restored.
Some examples are:

* Loss of flagella in *S.typhi* when grown in phenol agar (H-O variation)
* Pleomorphism (variation in shape) in old cultures
* Lack of pigment production by *S.aureus* in anaerobic conditions
* Formation of spheroplasts and protoplasts
* V-W variation in Salmonella typhi that is characterized by loss of Vi antigen
* S-R variation in *Salmonella typhi* that is characterized by loss of O antigen and change in colony morphology to rough type.

2.MICROBIAL RECOMBINATION.

 Bacterial recombination is a type of genetic recombination in bacteria characterized by DNA transfer from one organism called donor to another organism as recipient. This process occurs in three main ways;

* Transformation, the uptake of exogenous DNA from the surrounding environment.
* Transduction, the virus- mediated transfer of DNA between bacteria.
* Conjugation, the transfer of DNA from one bacterium to another via cell-to-cell contact.

 The final result of conjugation, transduction, and/or transformation is the production of genetic recombinants, individuals that carry not only the genes they inherited from their parent cells but also the genes introduced to their genomes by conjugation, transduction, and/or transformation.

 Recombination in bacteria is ordinarily catalyzed by a RecA type of recombinase. These recombinases promote repair of DNA damages by homologous recombination.

 The ability to undergo natural transformation is present in at least 67 bacterial species. Natural transformation is common among pathogenic bacterial species. In some cases, the DNA repair capability provided by recombination during transformation facilitates survival of the infecting bacterial pathogen. Bacterial transformation is carried out by numerous interacting bacterial gene products.