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Variability in Pathogenic Bacteria

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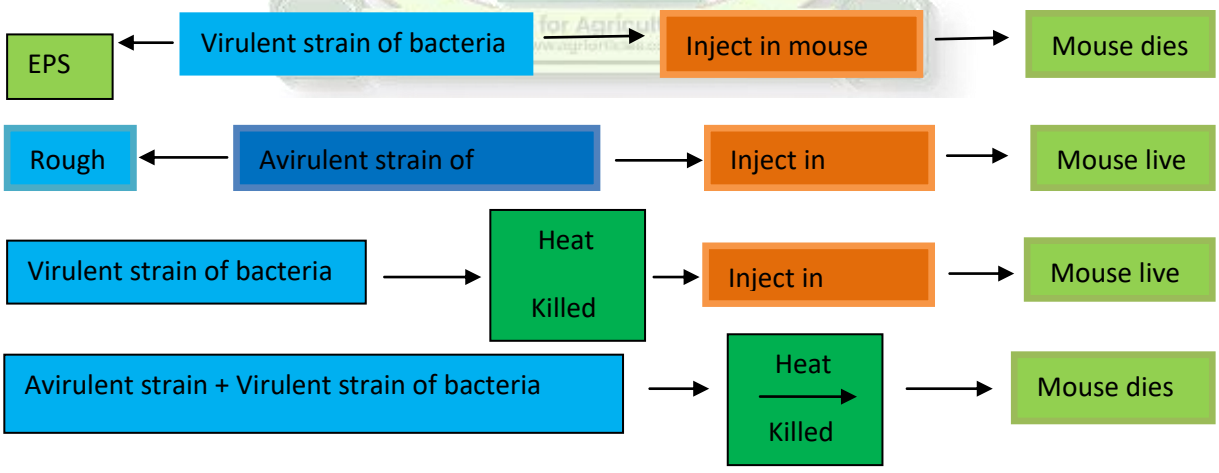
Any change in the genotype of a bacterium or its phenotypes is known as variation. In bacteria the DNA is present in chromosomes of the unorganized nucleus and also in plasmid. The transfer of the genetic material or characters coded in this material to daughter cells occurs at time of binary fission, the method by which bacteria including mycoplasmas multiply. Genotypic variation can occur by way of mutation, loss or acquisition of new genetic elements. These variations are heritable. Phenotypic variations are grown under certain environmental conditions. These variations are not heritable.

Heritable Variations

Mutation: A gene will change spontaneously, about once in a hundred million cell divisions. Such bacteria are called mutant. Most of these mutants die, but a when a mutants can adapt itself to the environmental more readily; it may emerge as a new variant. Chromosomal mutations may lead to materialization of drug resistance in bacteria. Examples include Methicillin resistance in Staphylococcus aureus, multi-drug resistance in Mycobacterium tuberculosis.

Transformation: In this process, the bacterial cells absorb the genetic material exuded by compatible cell or freed by lysis of the cell wall. The compatibility is supposed to be due to the presence of a specific protein on the surface of the recipient's cell. The recipient's cell then contains altered genetic material since new genes are added to it. This cell now reproduces to develop a new race.

Griffith's experiment: Some genes are transfer in avirulent stain by virulent heat killed strain. So avirulent starin becomes virulent starin.

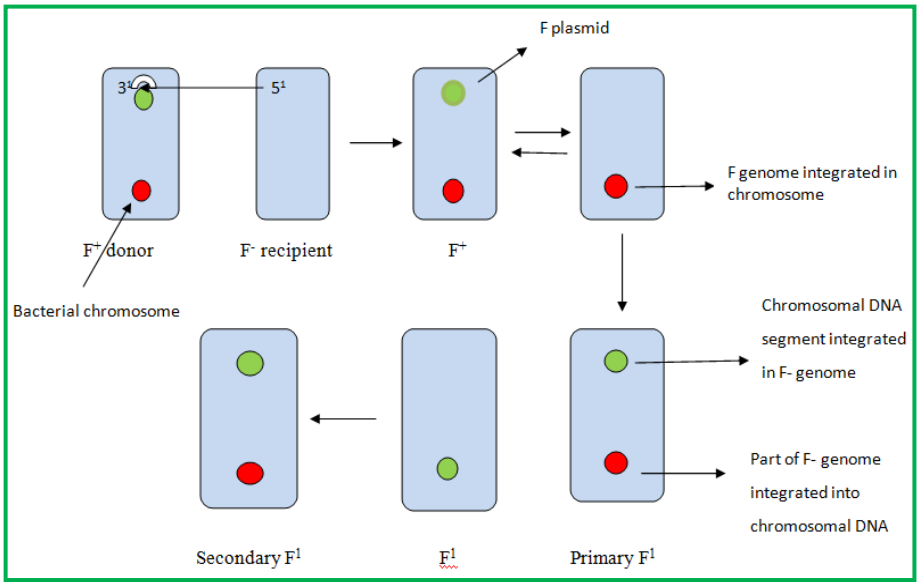


Conjugation

Bacterial conjugation is the transfer of DNA from donor to recipient cell via direct contact between donor to recipient cell. In 1946, Joshua Lederberg and Tatum discovered this process of gene transfer in E- Coli. The donor cell is called as F^+ because it has conjugative plasmid, mobilizing F-plasmid while recipient is called as F^+ Because the lacking of F-plasmid. During conjugation between Hfr and F- cells some parts of chromosomal DNA may get transfer along with plasmid DNA to the F-cells. F- cell become diploid for some homologous portion of it's chromosomal DNA, which is called partial zygote or merozygote.

Primary F- cell: The Hfr cell may reverse back to F^+ cell or vice versa. That is the F-genome in bacteria may convert to its free from (F^+ state) from integrated form (Hfr state). During reverse process from Hfr to F^+ form it not always possible to get back the original F-genome. F- genome may contain certain segment of chromosomal DNA. The progeny of such cell is called primary F^1 cells. In the primary F^1 cells certain chromosomal segments get deleted (as a result of integrated of that segment into the F- genome). In this plasmid segment which is having chromosomal DNA part which are responsible for survival which are necessary for bacteria survival then plasmid become indispensable.

Secondary F^1 cell: The progeny develop from primary F^1 cell and F- cell is called as secondary F^1 cell. The secondary F^1 cell contain chromosomal DNA which are partially diploid for a certain segment of the homologous region there for plasmid of secondary F^1 cell is not indispensable.



Transduction

Transduction is a process of gene transfer from donor cell to recipient cell with the help of virus bacterial DNA at the time of packaging and when such phages infect another bacterial host the recombination takes place in bacterial genome.There are two type of transduction:-

1. Generalized Transduction: In this process which leads to the bacterial chromosome into the viral capcid during the lytic cycle takes place. As a result of this new virus particle now loaded with bacterial DNA when such virus inject another bacterial cells transfer the bacterial genome into another bacteria. This kind of recombination is random and the quantity of recombination is depends on the size of the virus genome.

2. Specialized Transduction: This type of transduction is mediated only by temperate phages which integrate into the host chromosome. Only bacterial genes immediately adjacent to the prophase can be transferred.