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18/MHS06/029.
MCB 202
MEDICAL LABORATORY SCIENCE

Discuss Mutation and Heredity in Bacteria

Bacteria are prokaryotic cell that lack Nucleus and other organelle, they simply have a cell membrane, DNA closely around their Cytoplasm, ribosome, and are transform biosynthetically easily.

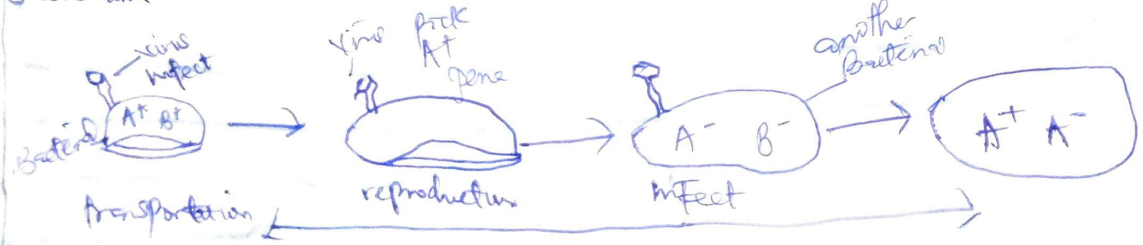
Bacterial divide by process known as Binary fission, whereby the Chromosome which is circular replicate and the cell simply divides in half which gives no genetic variability. but bacteria differs from each others and there are ways in which bacteria cell can give genetic variability and they are

1. Rapid reproduction
2. Genetic recombination
3. transformation.

1 Rapid reproduction: Bacterials reproduce in a matter of minutes because they are constantly reproducing their DNA, which give chance for the occurence of mutation.
Mutation is the Ultimate cause of genetic variation;

Genetic recombination: these involve three process that allow for genetic recombination, it's a result whereby two organisms recombine their materi and this lead us to the first process known as

Transduction: process whereby Phages (viruses) carrys or pick up Bacteria and Induces the gene of that bacteria into another Bacterium



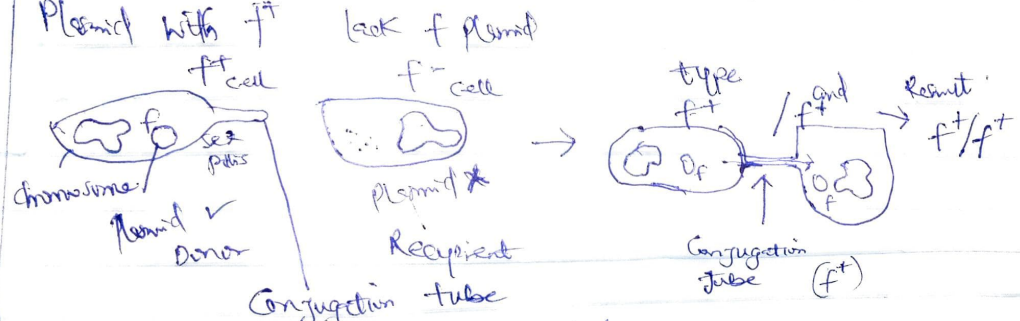
Transduction process (genetic diversity.

Conjugation: this is a process where two bacteria directly exchange genetic material between bacterial cell that are temporarily joined.

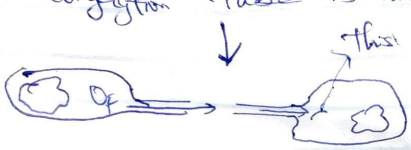
In Conjugation Bacterial Connect Though
and

Example(A) mutant Strain of bacteria that has ability to make arginine but not tryptophan and another(B) mutant strain of bacteria that could make tryptophan and not arginine, but both each of these was put on a bacterial plate lacking any amino acid; but the first (A) died due to lack of production of the tryptophan which it requires to live and B also but when A and B was mixed and placed in a Bacteria plate, the Bacterial plate Produce the amino acid that it requires to survive producing growth. this give rise to the idea that Bacteria could exchange genetic material with each other.

this DNA that is exchange in Conjugation is known as plasmid, which is a circular form of DNA bacteria Chromosome. In Conjugation, Plasmid get replicated and exchange through a sex pilus for example



If a Conjugation tube is disrupted



this fragment can either be destroyed or degraded with the help of nuclease.

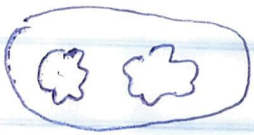
Type
f^+/F^-

Result
f^+ (Hfr).

OR

they can try to incorporate the fragment with the chromosom with the formation of homologous recombination

as the bacteria carry a fragment of plasmid and Chromosome. They may get rid of the plasmid at different time, by Cross-Linking.



Transformation: this is when bacteria pick up (DNA) Naked Dna from their environment, it involves the direct uptake of fragment of Dna by a recipient cell and the acquisition of new genetic Characteristics, there are two major parameter involved in efficiently transforming a bacteria organism

1) Induce competence: the bacterium must actuate a number of genes that express the required proteins, Bacteria usually transform Dna of the same species. transformation is used to induce foreign Dna into prokaryotic cells by incorporating the DNA in the growth medium. In this way, it effects of different Dna segments are created with desired traits.

2 Genetic recombination

Genetic recombination (known as genetic reshuffling) is the exchange of genetic material between different organisms which leads to production of offspring with combinations of traits that differs from those found in either parent. this process involves genetic variability which is a good thing.

This process is generally mediated by homology; that is, homologous regions of chromosomes line up in preparation for exchange, and some degree of sequence identity is required.

The role of recombination was first demonstrated through experiments, In 1931, Barbara mcClintock and Harriet Creighton obtained evidence for recombination by physically tracking an unusual knob structure within certain maize chromosomes through multiple genetic process.

Although common, genetic recombination is a highly complex process. It involves the alignment of two homologous DNA strands involving the breakage of each strand, exchange between the strands, and sealing of the resulting recombined molecules, these step of recombination can occur in two pathways, according to whether the initial break is single or double stranded, In the single-stranded model, following in the alignment of homologous chromosomes; a break is introduced into one DNA strand on each chromosome, leaving two free ends, each end then crosses over and invades the other chromosome, forming a structure called a "holiday junction". the

The next step called branch migration, takes place as the junction travel down the DNA, the junction is then resolved either horizontally which produces no recombination, or vertically, which results in an exchange of DNA.

In the alternate pathway initiated by double stranded breaks, the ends at the break points are converted into single strands by the addition of 3' tails. these ends can then perform strand invasion, producing two holiday junctions. from that point forward, resolution proceeds as in the single stranded model.

Types of Genetic Recombination

1 Homologous (General) recombination: it occurs between DNA molecule

of Similar Sequences

Non-homologous (illegitimate recombination) : this occur between DNA molecules that are not necessarily similar. often, there will be a degree of similarity between the sequences

Mostly mitotic during interphase which is the resting phase between mitotic divisions, the process is similar to that in meiotic recombination

Prokaryotic cells can undergo recombination through one of these three processes.

Con Jugation

~~transformation~~

Transduction