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Commentary

Transposable Element in Bacterial Pathogenesis

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DESCRIPTION

A DNA sequence known as a Transposable Element (TE, transposon, or jumping gene) can move positions within a genome, occasionally causing or reversing mutations and changing the genetic makeup and genome size of the cell. The same genetic material is duplicated frequently as a result of transposition. They were discovered by Barbara McClintock, who was awarded the Nobel Prize in 1983. Given the difficulties of analysis in very high dimensional spaces, its relevance in customised medicine is growing. It is also receiving increased attention in data analytics. Transposable elements account for a significant portion of the genome and most of the DNA mass in a eukaryotic cell. Although selfish genetic elements, TEs play a significant role in the evolution and function of the genome. Transposons are a highly helpful tool for scientists to modify DNA within a living organism.

There are at least two different types of TEs: Class I TEs, or retrotransposons, typically work by reversing transcription, but Class II TEs, or DNA transposons, make the transposase protein, which they need for insertion and excision, as well as other proteins in some cases.

Transposable Elements (TEs) are mobile DNA sequences that can move across a genome and change where they are located. The most prevalent and prevalent genes in nature, TEs and the related transposase genes are crucial for biological diversification and adaptation. According to estimates, TEs or their residual sequences make up 40% of the human genome and may contribute to disease in humans. The transposition of TEs within the genome is carried either by RNA or DNA. DNA sequences are "cut-and-pasted" into a new place inside the genome during DNA transposition. The simplest TEs are called Insertion Sequences (ISs), and they have a transposase gene that catalyses the migration of the IS through strand transfer and DNA cleavage, flanked by inverted terminal repeats (IRs). In contrast to ISs, other TEs like transposons typically contain extra "cargo" genes such genes for antibiotic resistance.Despite the fact that ISs are widely prevalent in bacterial genomes and that by 2015, more than 4000 distinct ISs had been identified, ISs are frequently disregarded.There is no strong necessity for homology between the DNA sequences at the ends of TEs and the location at which it seeks to integrate, unlike other mobile genetic elements (the target site). Because of their adaptability, TEs may be used to introduce genes from a vector into a genome and cause random mutations, which are two of their main applications. Because transposition disrupts the regulatory or coding sections of the host's genes, it was previously thought that transposition is typically neutral or even damaging to the host. However, research has revealed that ISs can provide a growth advantage by triggering biological functions as metabolic regulation, DNA repair, virulence, and antibiotic resistance. TEs have a substantial impact on how genes are shaped and how the evolution of the genome is accelerated. Despite the advantages noted above, TE expression is often tightly controlled. Because of the host's silencing of their genes, TEs are regarded as being "domesticated." Additionally, depending on the type of IS, the frequency of transposase expression and transposition activity are both regarded as low, with transposition rates ranging from 10^{-6} to 10^{-4} per cell per generation.

Small nonchromosomal DNA molecules termed plasmids are frequently found in many bacteria. Plasmids can be advantageous in some environments even though they are not necessary for regular bacterial growth and bacteria can lose or acquire them without any negative effects. A few proteins that are not encoded by the bacterial chromosome can be synthesised thanks to plasmids. Small fragments of DNA known as transposons (jumping genes) have enzymes that allow them to transfer from one DNA site to another. Transposons can be found in plasmids or as a component of a bacterium's chromosome. Transposons called integrons can transport gene cassettes, which are collections of genes, from one piece of DNA to another. A process known as horizontal gene transfer occurs when an organism sends genetic material to a cell that is not its progeny. A bacterial genome can undergo rather significant modifications as a result of horizontal gene transfer. In thecourse of bacterial evolution, Bacteria and Archaea commonly acquire new genes by horizontal gene transfer rather than by changing the functionality of existing genes through mutations.

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