

Plasmid

A plasmid is a type of self-replicating extrachromosomal DNA molecule. This DNA molecule can carry a few to several hundred genes. A plasmid can be used to multiply protein codes and cloning micro DNA segments. Plasmids can also be designed artificially through the cloning method by inserting any gene inside the bacterial cells.

A plasmid can be used to perform multiple functions, such as monitoring chemical levels in an environment, producing synthetic viruses, producing protein in large amounts, etc. We have shared the

Molecule Name	Plasmid
Plasmid Definition	An extrachromosomal DNA molecule with self-replicating property is known as plasmid.
Types of Plasmid	Col Plasmids, Resistance Plasmids, Fertility F Plasmids, Virulence Plasmids, Degradative Plasmids.
Length	1,000 to 100,000 or more base pairs.
Number of Genes	Half a dozen to many hundreds of genes.

Types of Plasmid

Broadly put, there are two types of plasmids - conjugative and non-conjugative. A conjugative plasmid can promote sexual conjugation between cells through the transfer of genes. On the other hand, non-conjugative plasmids are incapable of conjugation and can only be transferred through conjugative plasmids.

Classification of plasmids can also be done based on their incompatibility groups and functions. Here are the main types of plasmids -

- **Resistance plasmids** - Also known as R-factors, these plasmids contain genes that offer resistance against antibiotics.
- **Fertility plasmids** - These plasmids contain tra genes that are capable of conjugation.
- **Virulence plasmids** - They convert bacterium into pathogens.
- **Degradative plasmids** - These help with the digestion of unusual substances, such as salicylic acid and toluene.
- **Col plasmids** - This plasmid carries proteins that can kill other bacteria.

Characteristics of Plasmid

A plasmid is characterised by circular, supercoiled, and double-stranded DNA. Here, we have shared some of the characteristics of plasmid -

- Plasmids can replicate on their own and always carry at least a single gene.
- An essential characteristic of a plasmid is that it is a double-stranded DNA molecule.

- The number of plasmids that can exist in an individual cell range from one to many hundreds.
- There are many different types of plasmids, such as Col Plasmids, Fertility F Plasmids, Resistance Plasmids, Degradative Plasmids, and Virulence Plasmids.
- Plasmids that are larger in size generally have lower replicating genes.

Properties of Plasmid

The properties of plasmid are discussed in a tabular form below:

Property	Details
Molecular Weight	10 ⁶ -10 ⁸ or 40-50 genes
Number of Genes	Anywhere between half-a-dozen to hundreds
Feature	Plasmid can replicate itself independently
DNA Type	Circular, double-stranded and supercoiled
Replication	A plasmid can replicate on its own
Incompatibility	Two members belonging to the same group identity cannot coexist in a cell
Curing	A plasmid can be lost by curing agents
Recombination	Some types of plasmid, such as the episome, can integrate with the host chromosome
Transferability	Certain plasmids can transfer to the host chromosome on their own

Functions of Plasmid

Plasmids have a variety of functions. With their ability to replicate, they can be used for cloning important genes and substances. Here, we have shared some of the many important functions of plasmid:

- Protein production - Plasmid can help in the production of large amounts of protein that can be used for various purposes. Moreover, plasmid can also produce a glowing protein that can be tracked inside a cell.
- A plasmid can be used to generate synthetic viruses for use in research.
- Scientists use plasmids to monitor the chemicals present in an environment.
- Plasmid can offer genetic advantages to bacteria.

Significance of Plasmid

Plasmid are considered as some of the most significant microorganisms because they have allowed scientists to make some commendable discoveries. Here are some reasons why plasmid is considered significant -

- They allow scientists to study the movement of proteins in a cell.
- With the help of plasmid, scientists are able to put foreign DNA into bacteria.
- They transfer DNA with antibiotic resistance properties.
- Plasmid has contributed significantly to the development of molecular biotechnology.

How Does Plasmid Replicate?

The most important function of plasmid is that it can replicate itself as an extrachromosomal DNA molecule. But how does the self-replicating process occur in a plasmid? The process involves three stages -

- Initiation
- Elongation
- Termination

In the initiation phase, the plasmid strands begin to open in a theta displacement mechanism or rolling-circle replication. In the elongation phase, the plasmid occurs through DNA polymerase III holoenzyme and other host proteins that participate in the replication. During termination, the terminator protein creates a DNA that arrests the replication of plasmid.

Artificial Plasmid

There are two types of plasmid - natural and artificial. While natural plasmid exists naturally, artificial plasmids are generated in a lab by scientists. The construction of an artificial plasmid happens by recombining unique segments of two more plasmids. The plasmids selected for the recombining process can be natural or artificial in nature.

The development of synthetic plasmids happens in a laboratory where new plasmids are introduced to a host cell for replication. Through the process of artificial plasmid generation, scientists are able to transfer gene-modifying information into cells.

Natural Plasmid vs Artificial Plasmid

The major difference between natural and artificial plasmid are:

Natural Plasmid	Artificial Plasmid
It occurs naturally.	It is generated in laboratories by scientists.
Natural plasmids are transferred from one bacterium to another.	Artificial plasmids are generated by recombining the segments of two or more plasmids.
Natural plasmids can have limitations such as poor marker genes, too stringent, etc.	Artificial plasmid can be modified as per requirements and are used to overcome the limitations of naturally-occurring plasmid.