A brief note on non-natural Nucleic Acids for Synthetic Biology.

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Introduction

The crucial aspect of synthetic biology that involves gene manipulation can be made more difficult by unintended nuclease degradation. A gene may acquire resistance to nucleases and be given an expression boost if non-natural nucleic acids are incorporated into it. Review of non-natural nucleoside compatibility with polymerases is done with an emphasis on the last two years' worth of data. We describe the potential applications of the various systems in synthetic biology [1].

The goal of synthetic biology is to create living systems while also improving our understanding of life in general. The finer features of synthetic biology, such as bioengineering, biotechnology, molecular evolution, and systems biology, are developed in a number of recent reviews. Synthetic biology frequently involves the deletion and insertion of genes, and the use of synthetic nucleic acids might make genetic manipulation easier. Many chemistry-based research teams have proved over the past few decades that DNA and RNA are not the only chemical systems capable of storing genetic information. Aside from the conventional nucleoside triphosphates, investigations on polymerase replication and transcription of oligonucleotide sequences show that a variety of different chemical entities can be tolerated to varying degrees. As a result, it is possible to think of a synthetic cell's genetic information as being carried by a non-natural genetic system. The idea that a cell may be built to rely on a genome in which DNA and RNA are swapped out for different chemical entities is intriguing [2].

The majority of synthetic biology involves reprogramming the host genome while stealing or hijacking the host cell's existing components. However, this process can be hindered by the non-natural gene's breakdown. Recent difficulties with gene transfer between yeast and bacterial species were partially brought on by restriction endonuclease activity, which had to be inhibited before success could be achieved. Adding stability to endogenous proteins that are eager to break down natural nucleic acids would be a potential benefit of employing synthetic versions of DNA and RNA in synthetic biology. As a result of its resistance to degradation, a gene largely made up of non-natural nucleic acids might have a higher likelihood of being produced. Non-natural nucleosides have traditionally been difficult to include because they are incompatible with the enzymes that the body uses to reproduce nucleic acids, such as DNA and RNA polymerases. Recent developments, however, suggest that these obstacles might be overcome [3].

Exogenous nucleic acids are being investigated as potential therapeutic agents to address these genetic illnesses as a result of the genetic causes of many human diseases being discovered (inherited or acquired). Nucleic acids are susceptible to breakdown, but their physicochemical qualities also prevent them from entering cells and from correctly inhibiting or translating genes. Exogenous nucleic acids must therefore be guided intracellular trafficking and gene condensation/protection for them to function within cells. To enhance the intracellular transportation of exogenous nucleic acids, a variety of cationic formulation materials, including natural and synthetic lipids, polymers, and proteins/peptides, have been created. Understanding the property-function connection of the formulation materials will encourage the creation of next-generation gene delivery carriers since the chemical properties of various formulation materials dictate their special qualities for nucleic acid delivery. We will thus concentrate on the chemical characteristics of various formulation materials in this review and talk about how these formulation materials act as cellular guardians and pathfinders for nucleic acids, guiding them to their goal by overcoming various cellular barriers [4].

References

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***Received:** 03-Jan-2023, Manuscript No. AABB-23-85761; **Editor assigned:** 05-Jan-2023, PreQC No. AABB-23-85761(PQ); **Reviewed:** 19-Jan-2023, QC No AABB -23-85761; **Revised:** 23-Jan-2023, Manuscript No. AABB-23-85761(R); **Published:** 30-Jan-2023, DOI:10.35841/aabb-6.1.133*

***Citation:** Morange M. A brief note on non-natural nucleic acids for synthetic biology. J Biochem Biotech 2023;6(1):133*