Biochemistry and Molecular Biology Journal
ISSN: 2471-8084

Open access Perspective

# Transcribing the Genetic Code: Human DNA Polymerase

**Eva Root***

*Department of Bioscience, College of Science and Technology, Mexico*

## INTRODUCTION

In the intricate machinery of cellular life, DNA polymerase stands as a central architect, diligently transcribing the genetic code encoded in our DNA. As the enzyme responsible for synthesizing new DNA strands during replication and repair, human DNA polymerase plays a pivotal role in maintaining the integrity of our genetic information. This article embarks on a journey into the fascinating world of human DNA polymerase, exploring its structure, functions, and the indispensable role it plays in the perpetuation of life. DNA polymerase is a class of enzymes essential for the replication and repair of DNA. In the context of human biology, multiple DNA polymerases contribute to different aspects of genome maintenance. The primary function of DNA polymerase is to catalyze the synthesis of a complementary DNA strand during DNA replication, ensuring the faithful transmission of genetic information from one generation of cells to the next. The replication process is akin to a symphony, with DNA polymerase acting as the conductor, guiding the orchestra of nucleotides to create a harmonious and accurate copy of the genetic code. This precision is paramount, as errors in DNA replication can lead to mutations, genetic disorders, and the potential development of diseases.

## DESCRIPTION

The human genome encodes multiple DNA polymerases, each with specific roles and functions. These polymerases are categorized into families based on their sequence homology and functional characteristics. The major families include: Primarily involved in DNA repair processes, Family A polymerases play a role in maintaining genomic stability. DNA polymerase epsilon and DNA polymerase delta belong to this family and are crucial for leading and lagging strand synthesis during DNA replication. For their involvement in DNA repair mechanisms, Family X polymerases contribute to the fidelity of the genome. Often involved in translesion DNA synthesis, Family Y polymerases can replicate through damaged DNA, albeit with a higher error rate. The structure of human DNA polymerase reflects its intricate function. These enzymes consist of multiple domains that collaborate to achieve accurate DNA synthesis. The catalytic domain houses the active site responsible for adding nucleotides to the growing DNA chain. Additional domains contribute to processivity, proofreading, and interaction with other cellular components. Understanding the functions and characteristics of human DNA polymerases has profound implications for human health and disease. Dysregulation or mutations in these enzymes can contribute to various conditions, including cancer and genetic disorders. Aberrant DNA replication can lead to the accumulation of mutations, a hallmark of cancer. Dysfunctional DNA polymerases, or alterations in their regulation, may contribute to the genomic instability observed in cancer cells. Mutations in genes encoding DNA polymerases have been linked to genetic disorders characterized by impaired DNA repair or replication. For example, mutations in the POLG gene, which encodes a mitochondrial DNA polymerase, are associated with mitochondrial disorders.

## CONCLUSION

As technology advances, researchers delve deeper into the complexities of human DNA polymerase. Structural biology techniques such as X-ray crystallography and cryo-electron microscopy provide detailed snapshots of the enzyme's molecular structure. These insights open avenues for designing targeted therapies that modulate DNA polymerase activity for therapeutic purposes, such as in cancer treatment. Moreover, the exploration of DNA polymerases involved in translesion DNA synthesis holds promise for understanding how cells cope.

| | | | |
|---|---|---|---|
| **Received:** | 02-October-2023 | **Manuscript No:** | IPBMBJ-23-18420 |
| **Editor assigned:** | 04-October-2023 | **PreQC No:** | IPBMBJ-23-18420 (PQ) |
| **Reviewed:** | 18-October-2023 | **QC No:** | IPBMBJ-23-18420 |
| **Revised:** | 23-October-2023 | **Manuscript No:** | IPBMBJ-23-18420 (R) |
| **Published:** | 30-October-2023 | **DOI:** | 10.36648/2471-8084-9.05.44 |

**Corresponding author** Eva Root, Department of Bioscience, College of Science and Technology, Mexico, E-mail: Evaroote4484@gmail.com

**Citation** Root E (2023) Transcribing the Genetic Code: Human DNA Polymerase. Biochem Mol Biol J. 9:44.