

# Preface

More than any other class of enzymes, nucleic acid polymerases are directly responsible for an overabundance of enzymatic, regulatory, and maintenance activities in the cell. DNA polymerases accurately replicate copies of genomes in all forms of life as well as have specialized roles in DNA repair and immune response. RNA polymerases are most noted for their active roles in controlling gene expression during transcription but can also be utilized in self-replicating ribozymes and viral replication. Although the general sequence homology, structural architecture, and mechanism are conserved, they have evolved to incorporate deoxynucleotides (dNTPs) or ribonucleotides (rNTPs) explicitly. Various nucleic acid polymerases have specificities for RNA or DNA templates, incorporate dNTPs or rNTPs, and can be template dependent or independent. Here, we provide examples on the latest understanding of each class of nucleic acid polymerase, their structural and kinetic mechanisms, and their respective roles in the central dogma of life.

This book provides a catalog and description of the multitude of polymerases (both DNA and RNA) that contribute to genomic replication, maintenance, and gene expression. Evolution has resulted in tremendously efficient enzymes capable of repeated extremely rapid syntheses that have captivated researchers' interests for decades. We are inspired by work that started over 60 years ago and is actively pursued today for a fundamental understanding of life, contributions to human health and disease, and current and future biotechnology applications. Nucleic acid polymerases are fascinating on a number of levels, yet still continue to surprise us with novel modes of action revealed through ongoing and future studies described within this volume.

We wish to thank all the authors for their specific expertise and willingness to participate in this comprehensive review of nucleic acid polymerases. We are also grateful to the many investigators before us (including our research mentors: Stephen Benkovic and Akira Ishihama) who began and continue this important

line of research. We believe this book will be useful for a wide range of researchers in both the early and later stages of their careers. We would be thrilled if this volume becomes the go-to resource for nucleic acid polymerase structure, function, and mechanism for years to come.

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