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Autore	Nabeel Asim Muhammad
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Sommario/riassunto	Molecular biology is at the forefront of scientific discovery, unraveling the intricacies of life at the most fundamental level. As biological systems become increasingly complex, AI has emerged as a pivotal tool for unlocking new insights and enhancing our understanding of these systems. This volume focuses on the core principles of molecular biology while introducing AI-driven approaches to genomic and proteomic sequence analysis. It serves as a foundation for integrating computational methodologies into the study of biological systems. The chapters in this volume are structured to provide a comprehensive overview of the essential concepts, tools, and methodologies in molecular biology, enriched by the latest advancements in AI:

Fundamentals of Molecular Biology: This chapter delves into the foundational elements of molecular biology, exploring the central dogma, gene expression regulation, cellular organization, and the evolution of genome studies. DNA, RNA, & Protein Structures: This chapter outlines their fundamental properties and sets the stage for discussing AI-driven sequence analysis. Exploration of AI-Driven Genomic and Proteomic Sequence Analysis Landscape: This section provides an in-depth look at how AI is reshaping the field of sequence analysis. Topics include representation learning, feature engineering, predictive modeling, and an evaluation of performance metrics for AI-driven pipelines. Insights of Biological Databases: This chapter discusses the structure, organization, and utilization of key databases, emphasizing data formats, redundancy issues, and retrieval systems. DNA & RNA Sequence Representation Learning Methods: This chapter explores various encoding methods, from nucleotide distributions to Fourier transformations, providing a robust toolkit for researchers. Protein Sequence Representation Learning Methods: This section details diverse methodologies, including physicochemical properties, z-scales, and context-aware encodings. CRISPR System and AI Applications: This chapter examines AI-driven approaches to CRISPR-related tasks, from predictive modeling to dataset development, emphasizing the synergy between these transformative technologies. Through this volume, readers will gain a solid understanding of molecular biology and its convergence with AI. The interdisciplinary approach ensures that the biological complexities are complemented by computational rigor, laying the groundwork for the second volume, which delves deeper into advanced AI applications in molecular biology. .