

The quest to understand how nucleic acids function at the most fundamental level requires a detailed understanding of nucleic acid-metal ion interactions, as RNA and DNA are polyanions, their structures depend strongly on their association with metal ions. While scientists have appreciated the intimate connection between metal ions and nucleic acid function for decades, the noncovalent, dynamic nature of these interactions makes their accurate, quantitative description a challenge.

Over the past few years, the simultaneous development of solution-state spectroscopic techniques and achievement of high resolution X-ray crystal structures has provided tremendous insight into nucleic acid-metal ion interactions. This insight includes direct evidence for the importance of such interactions in determining nucleic acid structure over orders of magnitude in scale, from the folding pathways of large RNAs to the subtle modulation of DNA groove width.

Nucleic Acid-Metal Ion Interactions provides a comprehensive review of the experimental studies that define our current understanding of the subject, with a particular emphasis on biophysical studies. The book is not merely a current review of the literature, however, as the authors also present original material and fresh perspectives. The topics covered range from crystallographic studies of transition metal coordination by single nucleotides, to the application of polyelectrolyte theory in describing the delocalized counterions that surround nucleic acids in solution. Separate chapters describe how nucleic acid-metal interactions modulate both the kinetics and thermodynamics of RNA folding, play important roles in RNA catalysis, and how these interactions are even informing the design of new therapeutics.

The book is sufficiently detailed to serve as a reference for researchers active in nucleic acids biophysics or molecular biology. Additionally, chapter authors have supplied sufficient introductory and background material to make this book an accessible first resource for students and researchers who are just beginning to explore this dynamic field.

Cover image shows a metal ion bound in the minor groove of the DNA duplex [d(CGCGAATTCGCG)], at the central ApT step (derived from PDB structure BDL084).

RSC Biomolecular Sciences

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ISBN 978-0-85404-195-4



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