Methods in Enzymology: DNA Structures. Vol. 211, Part A: Synthesis and Physical Analysis of DNA. Vol. 212, Part B: Chemical and Electrophoretic Analysis of DNA by David M.J. Lilley and James E. Dahlberg, editors

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Reviewed by Victor Bloomfield, Department of Biochemistry, University of Minnesota

The last 15 years has seen a revolution in our understanding of the structural plasticity of DNA. We recognize a wide repertory of structures both local (B_I, B_{II}, Z, A, bulges, mismatches, etc.) and global (supercoils, cruciforms, triplexes, etc.). These structures are not just test tube curiosities, but often seem to have real functional significance. Fortunately, the armamentarium of techniques for delineating DNA structures has roughly kept pace with the proliferation of structural possibilities. This two volume set of *Methods in Enzymology* provides an up-to-date reference to nearly every important physical and chemical aspect of DNA structure and characterization.

Each of the two volumes has four major sections. Part A begins with a section on chemical synthesis of DNA, including chapters on deoxyoligonucleotides and their analogs, purification of synthetic DNA, synthetic oligos containing modified bases, and preparation of psoralen-derivatized oligodeoxyribonucleoside methylphosphonates.

The next section is entitled "Nonstandard DNA Structures and Their Analysis." It includes chapters on results of crystallography of the various DNA forms, A-DNA in solution, generation and detection of Z-DNA, supercoils and cruciforms, protonated DNA structures, guanine quartets, parallel-stranded duplexes, and crystallography of DNA containing mismatches and modified and unpaired bases.

The third section deals with spectroscopic methods for analysis of DNA. It includes chapters on NMR, both ^1H and ^{31}P, and discusses methods for obtaining furanose sugar conformations from NMR coupling constants. There are also chapters on infrared and laser Raman spectroscopy, fluorescence resonance energy, and circular dichroism spectroscopy.

The final section discusses various other methods for analyzing DNA structure and interactions. These include crystallization of DNA, dynamic light scattering for study of solution conformation and dynamics of superhelices, and computer modelling, both general aspects of molecular mechanics and molecular dynamics, and specific application of Monte Carlo simulation to supercoiled DNA. There are chapters on electron microscopic visualization of DNA and DNA-protein complexes as adjuncts to biochemical studies, on scanning tunneling microscopy (of which this reviewer was a coauthor), and on cryoelectron microscopy of DNA molecules in solution. The concluding chapters deal with solution behavior studied with magnetically induced birefringence, and with calorimetry as a tool to characterize DNA and ligand-DNA interactions.

Part B begins with a section on gel electrophoresis and topological methods for analysis of DNA structure. Chapters treat DNA bending, flexibility, and helical repeat by cyclization kinetics, analysis of DNA curvature in polyacrylamide gels, determination of global features of DNA structure by comparative gel electrophoresis, use of denaturing gradient gel electrophoresis to study conformational transitions, and two-dimensional gel electrophoresis of circular DNA topoisomers. The section concludes with a general discussion of the topological structures of DNA knots and catenanes.

The next section deals with probes of DNA structure in vitro. The expanding collection of sequence- and structure-specific chemical probes includes osmium tetroxide, haloacetaldehyde and diethyl pyrocarbonate, hydroxylamine and methoxylamine, hydroxyl radical, transition metal complexes, and psoralen. Other chapters discuss photofootprinting DNA in vitro, mapping adducts of DNA structural probes using transcription and primer extension approaches, and enzyme probes.

Next is a section on analysis of DNA structure inside cells. This carries forward themes from previous sections, including probing of DNA structure in cells with osmium tetroxide-2,2′-bipyridine, and analysis of in vivo supercoiling, topological domains, and DNA-protein interactions using psoralen photobinding. Also described are detection of non B-form DNA using enzymatic methylation, and topological approaches to studies of protein-mediated looping of DNA in vivo.

Volume 212 concludes with five articles on various aspects of DNA-protein interactions. These include assay of anti-DNA antibodies, recognition by protein of torsional stress-induced DNA conformations using topoisomer gel retardation, algorithms for prediction of histone octamer binding sites, methods to characterize and analyze the thermodynamics of ligand-nucleic acid interactions, and the use of fluorescence methods to determine nonspecific ligand-DNA equilibrium binding parameters. This small set of articles supplements Volume 208 in this series, edited by Robert Sauer, on *Protein-DNA Interactions.*

This set maintains the high standards of *Methods in Enzymology* for authoritative, useful presentations of practical procedures in molecular biophysics and biochemistry. The authors are all recognized experts, often the prime authority on the topic. Most of the chemical and biochemical articles contain enough detail that they can serve as sufficient guides for performing the indicated experiments. That is not so true

of the chapters on the more elaborate physical methods, such as crystallography, NMR, and computer simulation, where the reader is properly directed to other sources for details of procedure and analysis. A couple of other articles are primarily reviews of results obtained with the technique. What raises *DNA Structures* above the expected collection of methodological recipes is the effort devoted by the authors and editors to put the methods into a broad perspective. These books should be on the lab bookshelf of all research groups working on DNA.