

CHROMATIN AND CHROMATIN REMODELING ENZYMES

Volume 377

C. David Allis & Carl Wu

Methods in Enzymology

Volume 377 CHROMATIN AND CHROMATIN REMODELING ENZYMES Part C

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Chromatin and Chromatin Remodeling Enzymes

Part C

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Preface

A central challenge of the post-genomic era is to understand how the 30,000 to 40,000 unique genes in the human genome are selectively expressed or silenced to coordinate cellular growth and differentiation. The packaging of eukaryotic genomes in a complex of DNA, histones, and nonhistone proteins called chromatin provides a surprisingly sophisticated system that plays a critical role in controlling the flow of genetic information. This packaging system has evolved to index our genomes such that certain genes become readily accessible to the transcription machinery, while other genes are reversibly silenced. Moreover, chromatin-based mechanisms of gene regulation, often involving domains of covalent modifications of DNA and histones, can be inherited from one generation to the next. The heritability of chromatin states in the absence of DNA mutation has contributed greatly to the current excitement in the field of epigenetics.

The past 5 years have witnessed an explosion of new research on chromatin biology and biochemistry. Chromatin structure and function are now widely recognized as being critical to regulating gene expression, maintaining genomic stability, and ensuring faithful chromosome transmission. Moreover, links between chromatin metabolism and disease are beginning to emerge. The identification of altered DNA methylation and histone acetylase activity in human cancers, the use of histone deacetylase inhibitors in the treatment of leukemia, and the tumor suppressor activities of ATP-dependent chromatin remodeling enzymes are examples that likely represent just the tip of the iceberg.

As such, the field is attracting new investigators who enter with little first hand experience with the standard assays used to dissect chromatin structure and function. In addition, even seasoned veterans are overwhelmed by the rapid introduction of new chromatin technologies. Accordingly, we sought to bring together a useful "go-to" set of chromatin-based methods that would update and complement two previous publications in this series, Volume 170 (Nucleosomes) and Volume 304 (Chromatin). While many of the classic protocols in those volumes remain as timely now as when they were written, it is our hope the present series will fill in the gaps for the next several years.

This 3-volume set of *Methods in Enzymology* provides nearly one hundred procedures covering the full range of tools—bioinformatics, structural biology, biophysics, biochemistry, genetics, and cell biology—employed in chromatin research. Volume 375 includes a histone database, methods for preparation of

histones, histone variants, modified histones and defined chromatin segments, protocols for nucleosome reconstitution and analysis, and cytological methods for imaging chromatin functions *in vivo*. Volume 376 includes electron microscopy and biophysical protocols for visualizing chromatin and detecting chromatin interactions, enzymological assays for histone modifying enzymes, and immunochemical protocols for the *in situ* detection of histone modifications and chromatin regulators, methods for the preparation and analysis of histone modifying and ATP-dependent chromatin remodeling enzymes, and assays for transcription and DNA repair on chromatin templates. We are exceedingly grateful to the very large number of colleagues representing the field's leading laboratories, who have taken the time and effort to make their technical expertise available in this series.

Finally, we wish to take the opportunity to remember Vincent Allfrey, Andrei Mirzabekov, Harold Weintraub, Abraham Worcel, and especially Alan Wolffe, co-editor of Volume 304 (Chromatin). All of these individuals had key roles in shaping the chromatin field into what it is today.

> C. DAVID ALLIS CARL WU

Editors' Note: Additional methods can be found in Methods in Enzymology, Vol. 371 (RNA Polymerases and Associated Factors, Part D) Section III Chromatin, *Sankar L. Adhya and Susan Garges, Editors.*

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