310
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W. Doerfler and P. Böhm (Eds.)

DNA Methylation: Development, Genetic Disease and Cancer

With 25 Figures and 10 Tables

Springer

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Cover Illustration:
Random distribution of parental chromosomes during somatic cell division. Fluorescence in situ hybridization with differentially labeled centromeric satellite DNAs was used to distinguish between maternal Mus musculus and paternal M. spretus chromosomes in a mouse hybrid metaphase.

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Preface

Volume 301 of *Current Topics in Microbiology and Immunology, DNA Methylation: Basic Mechanisms*, which was published earlier this year, provided an introduction to the field and summarized ongoing research on elementary mechanisms related to DNA methylation. Due to the delayed availability of some of the manuscripts scheduled to appear in the book, the chapters dealing with the significance of this genetic signal for development, genetic disease, and cancer were assigned to this follow-up volume.

Obviously, the study of DNA methylation has had a profound impact on research in many areas of biomedicine. By January 2006, there were well over 10,000 citations in PubMed on DNA methylation and its ramifications. It has become clear that we need to re-sequence the human and other genomes at least partly to obtain a true account of the distribution of the fifth nucleotide in functional genomes. At this time, we are far from understanding the regulatory and structural functions that the fifth nucleotide exerts on chromatin.

What, for many years, seemed to be the almost-forgotten fifth nucleotide in DNA, 5-methyldeoxycytidine (5-mC), has now been generally recognized as one of the important topological signals in molecular genetics. In an intricate way and in conjunction with histone modifications, 5-mC residues in highly specific locations in a nucleotide sequence play crucial roles in long-term gene silencing and in influencing chromatin structure. The two mechanisms are probably intimately connected. Moreover, the genomes of many organisms are characterized by unique patterns of DNA methylation that can differ from genome segment to genome segment and cell type to cell type. These patterns can be instrumental in determining cell type and function. Studies on the role of DNA methylation have now moved center stage in many fields of biology and medicine such as developmental biology, genetic imprinting, genetic disease, tumor biology, gene therapy, cloning of organisms, and others. Again, basic research in molecular biology has opened new vistas for biomedical problems.

In this volume, the 12 contributions written by experts in the fields of development, genetic disease, and cancer biology deal with the role of DNA methylation in biology and pathogenesis. The series *Current Topics in Microbiology and Immunology* continues a long-standing tradition in that it offers indispensable reading in many fields of biology and medicine for novice and expert alike.

Erlangen/Köln, January 2006 *Walter Doerfler*

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