PREFACE

Homologous genetic recombination remains the most enigmatic process in DNA metabolism. The molecular machines of recombination preserve the integrity of the genetic material in all organisms and generate genetic diversity in evolution. The same molecular machines that support genetic integrity by orchestrating accurate repair of the most deleterious DNA lesions, however, also promote survival of cancerous cells and emergence of radiation and chemotherapy resistance. The machinery and the cellular process of recombination are intrinsically interconnected with those of DNA replication and repair. Recent work from many labs has revealed new and deeper connections between these 3Rs of genome maintenance.

These two volumes in this "Mechanisms of DNA Recombination and Genome Rearrangements" set offer a comprehensive set of cutting-edge methods to study various aspects of homologous recombination and cellular processes that utilize the enzymatic machinery of recombination. The two volumes feature contributions by the leading experts in the field of DNA repair, recombination, replication, and genome stability. The chapters within document methods are presently cutting edge, but will become a standard laboratory practice in the years to come. The first volume in the set (Volume 600, "Mechanisms of DNA Recombination and Genome Rearrangements: Methods to Study Homologous Recombination") concerns with the methods to study the initiation of homologous recombination, the central step in recombination, which involves formation of the recombinase nucleoprotein filament, homology search and DNA strand exchange, and the methods to study the processing of the recombination intermediates through resolution or dissolution. The second volume in the series (Volume 601, "Mechanisms of DNA Recombination and Genome Rearrangements: Intersection Between Homologous Recombination, DNA Replication, and DNA Repair") focuses on the methods to study the interface between recombination and replication, selection of recombination as homology-directed DNA repair pathway, homologous recombination machinery as a target for anticancer drug discovery, and meiotic recombination. In addition, the second volume covers a number of topics that recently emerged in the field of recombination, including mutagenesis associated with recombination, recombination between RNA and DNA, recombination initiated by DNA nicks, and recombination in a context of heterochromatin.

We selected the topics and contributors with a goal that these volumes to become a useful reference for the researchers engaged in the field of DNA repair, DNA recombination, DNA replication, and genome stability. The techniques described in the chapters range from cellular imaging to biochemical, structural, and single-molecule approaches, to drug discovery and next-generation sequencing. We hope to see this two-volume set as a well-used reference in the labs actively studying these processes and those contemplating entering the field. The chapters are written in a way to make the methodology accessible not only to the established experts but to a broader group of researchers, from undergraduates and rotation students to postdoctoral fellows and faculty who wish to expand their research programs.

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