Preface

Our understanding of the function and structure of chromosomes and their interrelationship has improved in recent years. The chapters of this issue describe the advances of combining microscope techniques with sophisticated biochemical and genetic approaches to unlock the secrets of chromosomes. Different aspects of chromosome biology, such as protein, DNA and RNA composition of chromosomes, defined chromosome structures, unusual chromosome structures and specialized chromosomes and microscope tools for chromosome analysis will be addressed.

N. Roberts and colleagues (University of Birmingham, UK) review the organization, interphase distribution and dynamics of telomeres in the somatic cell and meiocytes of plants, focusing on the model plant *Arabidopsis thaliana*. Live imaging combined with the molecular, genetic and cytological resources available in *Arabidopsis* will lead to significant advances in our understanding of plant telomere biology.

In plants as in other eukaryotes, structural maintenance of chromosome (SMC) protein complexes and proteins interacting with them are essential for sister chromatid cohesion, chromosome condensation, DNA repair and recombination. V. Schubert (IPK, Gatersleben, Germany) summarizes the multiple functions of plant SMC complexes and some of the particularities of these proteins are shown compared with those of other organisms.

K. Fukui (Osaka University, Japan) gives an overview of chromosome imaging methods with special reference to identification of small plant chromosomes and development of their quantitative chromosome maps. To un-

derstand more fully the protein framework of chromosomes the author describes effective proteomic approaches. Based on the proteome analysis of human metaphase chromosomes over 200 proteins have been identified, and are categorized into 4 distinct groups according to their nature and localization on chromosomes.

The formation of a new centromere has been proposed to underlie key evolutionary events such as rapid centromere evolution, hybrid incompatibility, and speciation. C.N. Topp and his colleagues (University of Georgia, USA) observed the formation of a plant neocentromere, and these observations support the view that neocentromere formation is generally associated with major genomic disturbances such as found in wide species crosses or the deletion of an existing centromere. The data further suggest that new centromeres may undergo a period of instability that is corrected over several generations.

To study the ultrastructural organization of different types of centromeres, E. Schroeder-Reiter and G. Wanner (Ludwig-Maximilians-University, Germany) investigated with high resolution field emission scanning electron microscopy (FESEM) mitotic metaphase chromosomes of different plants and animals. Analytical FESEM techniques revealed that centromere variants and ultrastructural elements in the centromere differ in DNA and protein distribution. For the first time, the interior centromere structure could be visualized with a novel application of FESEM combined with focused ion beam milling.

E. Gaginskaya and her colleagues (Saint-Petersburg State University, Russia) summarize the properties of lampbrush chromosomes and discuss the advantages of such chromosome types for the investigations of chro-

mosome structure and genome function. Recent findings are presented concerning the organization of transcriptionally active and silent chromatin together with the involvement of cohesin and condensin complexes in the maintenance of structural integrity of lampbrush chromosomes.

Transcripts of satellite DNA represent an integral component of heterochromatin and are implicated in its assembly. The study of transcription of pericentromeric satellite DNA of beetle performed by Ž. Pezer and Đ. Ugarković (Ruder Bošković Institute, Zagreb, Croatia) supports the functional significance of long stable transcripts as well as of promoter elements residing within satellite repeats.

N.I. Erukashvily and colleagues (Institute of Cytology, St. Petersburg, Russia) focused on the spatial localization of satellite DNA and its transcriptional status in mouse embryonic stem cells. Data suggest that cell differentiation is accompanied by the reorganization of the nuclear 3D structure.

SAF-A/hnRNP-U is an abundant nuclear protein that interacts specifically with nuclear matrix attachment region DNA and RNA as a component of heterogeneous nuclear ribonucleoproteins. A.S. Kukalev and colleagues (Institute of Cytology, St. Petersburg, Russia) trace the localization of SAF-A/hnRNP-U in interphase and metaphase cells.

X. Sun and J.A. Birchler (University of Missouri, USA) report on the effect of ectopic expression of *male specific lethal 2* (*msl2*) on chromatin modification and gene expression in *Drosophila* diploid females and metafemales (3X;2A). The results demonstrate that the expression of X-linked genes is not affected by the targeting of the MSL complex.

N. Shimizu (Hiroshima University, Japan) comprehensively reviews recent findings on the biology of mammalian extrachromosomal double minutes and chromosomal homogeneously staining regions, and extends our understanding of the mechanism of gene amplification and the behavior of amplified genes.

S. Cohen and D. Segal (Tel-Aviv University, Israel) summarize research on a more common type of eukaryotic extrachromosomal circular DNA (eccDNA), which is derived primarily from chromosomal repetitive sequences. The possible implications of eccDNA on the dynamics of chromosomal tandem repeats are discussed.

To overcome problems associated with the high proportion of repetitive sequences of large genome species, S.M. Stack and colleagues (Colorado State University, USA) demonstrate how fluorescence in situ hybridization can aid sequencing of the tomato genome by cytologically demonstrating the location of selected BACs on pachytene chromosomes.

S. Müller (Ludwig-Maximilians-University, Planegg-Martinsried, Germany) and his colleagues report on the establishment of a multi-color FISH protocol that allows simultaneous visualization of DNA probes labeled with organic fluorochromes and with Quantum dot conjugates. Initial results are also provided on high resolution 4Pi microscopy of mammalian chromosome territories using this promising methodology.

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