Book Reviews

Molecular Biology of the Chromosome

Cold Spring Harbor Symposia on Quantitative Biology. Vol. 38, Chromosome Structure and Function. Papers from a symposium, Cold Spring Harbor, N.Y., May 1973. Cold Spring Harbor Laboratory, Cold Spring Harbor, N.Y., 1974. xxii, 1010 pp., illus. $30.

While the central role of the chromosomes is fundamental to our concepts of development and heredity, these organelles have, until recently, been disappointingly inaccessible to attempts to elucidate their basic structural and functional organization. The physical and chemical complexities of eukaryotic chromosomes have made difficult the successful application of the sophisticated techniques of molecular biology that were so powerful in contributing to our understanding of simpler genetic systems.

Chromosome Structure and Function shows clearly that more than a beginning has been made toward a description, if not yet a full understanding, of chromosomes at the molecular level. Most of the 95 papers included in this symposium volume, covering topics ranging from operator regions in bacteriophage lambda and *Escherichia coli* to B chromosomes in grasses and grasshoppers, consider in various ways problems of the organization of DNA and proteins in chromosomes, transcription of chromosomal DNA, and, to a lesser extent, duplication of chromosomes. While almost overwhelming quantities of data, some of which have been published previously, are presented, there is general agreement on several aspects of the chromosome and no lack of speculation on others that are less well understood.

One long-standing problem that now appears to be resolved is that of chromosome strandedness. The hypothesis that each unduplicated chromosome contains only one double helix of DNA is very strongly supported by the demonstration that cells contain DNA molecules of molecular weights almost exactly equivalent to the estimated DNA contents of individual chromosomes. This is elegantly shown by Kavenoff *et al.*, using chromosomally different strains and species of *Drosophila*, and by Petes *et al.* and Cryer *et al.*, using aneuploid strains of yeast.

From the large number of papers in this symposium describing work in which nucleic acid hybridization techniques are used, it is apparent that these are the most popular, and probably also the most powerful, probes currently available for the analysis of the organization and transcription of chromosomal genes. Many of the data obtained by such techniques support the hypothesis that there is a large proportion of unique sequences of DNA in the eukaryotic genome, many of which are interspersed with shorter, repeated sequences. The use of RNA to elucidate the arrangement of sequences in the DNA from which it is transcribed is especially impressive; the results are interpreted by several authors as showing that the transcriptional unit consists of repeated sequences adjacent to the coding sequence of the structural gene. Some of the repeated sequences are transcribed and may even be retained in messenger RNA (mRNA) molecules, although the latter does not seem to be the case with the hemoglobin mRNA discussed by Bishop and Freeman. Whatever the fate of the transcribed repetitive sequences, the data support the attractive hypothesis of Britten and Davidson that repeated sequences may be involved in regulation of transcription or translation.

The origin and maintenance of the tandemly linked repeated sequences coding for ribosomal RNA are discussed at some length, and mechanisms for amplification, magnification, and rectification are suggested. Speculation on the role of simple-sequence DNA's is noticeably absent, and more attention is paid to evolutionary aspects of these highly repeated sequences than to their function; it is clear, however, that the unfortunate tendency to assign repeated-sequence DNA's without known function to categories of "redundant," "nonsense," or "junk" DNA is much less prevalent than before.

The one-to-one relationship between bands of polytene chromosomes and units of genetic function appears to be well established, as is illustrated in papers by Judd and Young, Hochman, and Lefevre. Especially fascinating is the fate of the DNA of individual bands of polytene chromosomes of the ciliate *Stylonychia*; Prescott and Murti review the evidence that this DNA is degraded to "gene-sized" fragments which then undergo multiple replications to form the mature macronucleus. Clearly the maintenance of a linear chromosome is not required in this specialized type of nucleus.

Neither the nature nor the functions of the associations of chromosomal proteins with DNA have been established. Speculative models of chromosome fiber organization are again presented here, but the differences in interpretation are sufficient to illustrate the lack of understanding in this field. Both histone and nonhistone proteins are implicated in regulation of gene expression, although the significance of the complex modifications shown to be undergone by these proteins is not yet clear.

The large number of papers included makes for considerable variation in style of presentation and ease of reading. Overall, however, this volume succeeds not only in illustrating the major areas of chromosome research but also in pointing out that, despite the enormous gaps in our knowledge, the "sense of excitement" mentioned in the foreword is fully justified.

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Cells in Culture

Biology of Fibroblast. Proceedings of a symposium, Turku, Finland, Aug. 1972. E. KULONEN and J. PIKKARAINEN, Eds. Academic Press, New York, 1973. xiv, 690 pp., illus. $35.50.

The title of this book is not only awkward, it is misleading, since only a small fraction of the 60 chapters deal specifically with fibroblasts. Most of the chapters (which are authored by a total of 127 investigators) discuss results of research on cells other than fibroblasts concerning such matters as cell metabolism, collagen biosynthesis, biochemistry of the extracellular matrix and the cell surface, tissue inflammation, repair and fibrosis, and components of the vascular wall.