Chromosome Organization

There is a difference in the general thinking of the early 1950's and that of the middle 1960's with respect to chromosome organization. Ten to fifteen years ago, when the terms *chromosome phenotype, chromosome gradient,* and *chromosome organization* were introduced, the general attitude was dominated by what Ernst Mayr calls "beanbag genetics." At that time those terms seemed to many geneticists premature or unjustified. We had to wait until the link between genetics and biochemistry was established for the new approach to be accepted. The study of DNA replication in chromosomes and the gene behavior in microorganisms has suddenly exposed a large number of investigators to pressing problems on interactions between chromosomal segments with the result that, in the last years, the new concepts of chromosome organization and gene interaction have become part of the general thinking. **The Role of Chromosomes in Development** (Academic Press, New York, 1964. 302 pp., $11) edited by Michael Locke, illustrates this trend. Among its contributors are some who, a few years ago, would have avoided using the terms *chromosome phenotype* and *chromosome gradient* but who now take these concepts for granted. Of the many symposia on chromosomes that are published, this is a publication that deserves special attention. The subjects chosen by the editor have resulted in a coherent attempt to elucidate chromosome structure and function, a task usually difficult to achieve in a symposium. Few other publications on the subject cover the field so well.

The Role of Chromosomes in Development opens with an introductory chapter by M. Markert which is a summary of the other articles presented in the volume. At present, the role of DNA in the chromosome is relatively clear, but the role of the protein and other molecules is not equally well understood. DNA builds complexes with these molecules, and the interactions thus established are of paramount importance for the understanding of gene expression and its relation to development. This is the main theme treated in the various chapters that constitute this book.

In the first chapter M. J. Moses and J. R. Coleman discuss chromosome organization in relation to DNA and protein replication as well as the arrangement of chromosomes in the sperm of insects. The authors also point out that there is not yet a plausible link betwen the pachytene chromosome structure seen with the electron microscope, the mechanism of crossing over, and the time of DNA replication at meiosis. Of the three main components of the chromosome—DNA, RNA, and protein—the least well known are chromosomal proteins, which are divided into three groups: (i) histones, (ii) acidic nuclear proteins or structural proteins, and (iii) aggregate enzyme systems. During the course of the organism's development, the DNA does not seem to be altered, but the histones and the acidic nuclear proteins are supposed to influence cell function. It can be shown that histones have a stimulatory or an inhibitory effect on RNA labeling (Busch, Starbuck, Singh, and Ro). The binding of actinomycin to DNA contributes to clarifying the problem of interaction of DNA with protein in relation to cell differentiation. Actinomycin at low concentrations inhibits DNA-dependent RNA synthesis, but does not impair DNA replication. It forms reversible complexes with DNA, but not with other cellular components. Of the four bases in DNA, only guanine is indispensable for binding actinomycin. These three properties of actinomycin fit well into a mechanism that would involve regulation of gene action by a protein (Reich). The problem of gene regulation leads to the discussion of the pattern of DNA replication in mitotic chromosomes of higher animals, and the relation of heterochromatin to DNA replication (Hsu, Schmid, and Stubblefield). The localized synthesis of DNA observed in polytene chromosomes also has implications connected with this phenomenon (Plaut and Nash). Edström discusses the function of chromosomal RNA and other nuclear RNA fractions. It seems well established that at least part of the nucleolar RNA is transported to the cytoplasm as ribosomal RNA and that this RNA is coded by a small fraction of the genome.

That the late-replicating X chromosome of mammals is instrumental in gene inactivation is disclosed by interactions of its heterochromatin with neighboring genes. This phenomenon is studied in translocations involving the X chromosome and autosomes of the mouse. The inactivation of autosomal genes proceeds from one point of the X, and the degree of inactivation is dependent on the position of the rearrangement points (Russell). Brink has also made extensive studies of the interactions between genes in maize. These involve genetic repression of certain loci in which gene expression varies with the genetic "history" of the allele. The occurrence of clusters of closely linked genes with similar effects which control the course of development of certain body segments of *Drosophila* is also given as an example of systems of gene interaction that may help us to understand the coordination of development (Lewis). Finally, Nanney describes the macronuclear differentiation and subnuclear assortment in Ciliates which lead to the disintegration of macronuclei and micronuclei, and to the establishment of nuclear interactions that decide the fate of the different nuclei within the body of the Ciliates.

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Aerodynamics and Physics

The Dynamics of Real Gases. J. F. Clarke and M. McChesney. Butterworth, Washington, D.C., 1964. x + 419 pp. Illus. $17.50.

A review of V. Rojansky's *Introductory Quantum Mechanics*, which I wrote for *The Purdue Engineer* in March 1940 concludes as follows: "Of what value is quantum mechanics to the engineer? It required more than half a century before the mathematical principles of electromagnetism reached fruition in the useful arts of