

loci t and l , and between b and m , which Catcheside has made on the basis of Lederberg's data, are invalid. As Lederberg himself rightly pointed out, the data only permit the estimation of the recombination fraction between th and m or b . We cannot, for example, use the data to estimate the extent of recombination between b and m without knowing the order of the loci th , b and m , which is uncertain. Similarly with t and l .

In spite of the above criticisms of detail, this book is certainly one of the first attempts to provide a broadly based and comprehensive text-book on microbial genetics, and it will no doubt do much to encourage further interest and research.

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GENETICS IN THE 20TH CENTURY. Essays Edited for the Genetics Society of America by L. C. Dunn, The Macmillan Company, New York. 1951.

This volume contains twenty-six essays presented at the "Golden Jubilee of Genetics" meeting of the Genetics Society of America. Most aspects of genetics are covered and a short review can do no justice to such a pleasantly varied collection of essays, none of which is irrelevant. I shall therefore pick a few points which have struck me as unexpected or more important.

In the first place, an impression which I hope to be wrong: in some of the theoretical parts of papers dealing with fundamentals one senses a somewhat defensive attitude; this is reflected in a categorical re-statement of concepts—e.g. unequivocal separation of hereditary and non-hereditary changes; genetic "control" of development; randomness of mutation, etc.—the usefulness of which we know to be the greater the more constantly aware we are of their limited validity and the more eager we are to replace them as soon as a higher synthesis is possible. Mendel's independent assortment was broadened to include linkage; his elements have been replaced by the functions of definite chromosome regions; particulate heredity has been harmonised with Darwinism; the gene-character gap is still there but at least we begin to see clearly the nature of the problem. Are we to believe that concepts as those mentioned above (and even more, that of "self-reproducing" particles) are eternal? If this stiffening attitude were the result of the bitter attacks now raging against genetics, both from the obscurantist biological right and the political extreme left, this would be indeed a victory for the attackers.

Fortunately in other theoretical essays, or theoretical parts of essays, there is no trace of this psychological weakness. Mather, writing on "Progress and Prospect of Biometrical Genetics", definitely uses the past as a stepping-stone for the future. So do Sonneborn and Ephrussi in their outstanding essays on cell heredity and differentiation. So do Darlington and Lederberg in those parts of their essays where they unify infection and heredity. There is no trace of defensive attitude in the numerous essays which deal with particular fields of experimental genetics or with the application of genetics to agriculture, medicine, and, more generally, human affairs. This is natural because who grapples daily with practical problems of experimental design and analysis in genetics cannot fail to be fascinated by the tremendous predictive value of genetical theory though he realises its limitations. Even Huxley, in his beautiful closing essay, raises well above the stiffening attitude, in which he has recently indulged, when he tries to visualise on the basis of genetical knowledge the novel evolution made

possible in man by the emergence of mind and by the pooling of experience through tradition.

A second point which has struck me as requiring searching analysis, is the extensive and loose use now prevalent of the concept of "self-reproducing" particles or structures. A salutary criticism is to be found at the end of Sonneborn's essay. We all agree that there are cell structures ranging from chromosomes and their parts to viruses and transforming principles, which the cell is usually unable to synthesize *de novo*, and that certain changes in such structures lead to synthesis of replicas of the changed type. If we use the term "self-reproduction" in this descriptive sense, and remember the simple analogy with the "self-reproduction" of glycogen in the presence of a trace of it, of the appropriate enzymes and of glucose-phosphate, there is no harm. However, there is an animistic tendency to attribute to genes, viruses and other such particle properties well beyond these. When we speak of the gene as reproducing *itself*, and *controlling* a metabolic process we tend to think of it as a *wee one*; but immediately afterwards we see it as a macromolecule. This makes for unclear thinking; the sooner we stop using the term "self-reproduction" the better; "genetic continuity" is safer, and the emphasis should shift on to the action of all these structures as specific primers and the part they play in the synthetic processes of the cell.

A third point is the small amount of attention which is at present paid to the problems of spatial organisation of biochemical processes in the cell. Apart from a passing remark by Sturtevant on the promise of position effects, a reference by Darlington to Peters' ideas and one by Sonneborn on the possible assembly-line systems of enzymes on the microsomes there is barely any mention of this problem. Yet, as the reviewer has been stressing for some time, biochemistry is reaching a dead end if it does not find means to bring in the space variable, and genetics has to offer, with crossing-over, a tool of structural analysis the extraordinary resolving power of which is unlikely to be equalled for a long time.

It is impossible to mention here all the twenty-six essays, let alone to do them justice. Some are of historical character and they make most instructive reading. Some are reviews of well delimited fields—such as one on immunological genetics by Irwin, one on chemical genetics by Beadle, one each on cytochemistry by Mirsky and by Caspersson and Schultz, one on bacterial genetics by Lederberg, one on the genetics of cancer by Little, one on population genetics by Dobzhansky, an excellent one on hybrid corn by Mangelsdorf, one on genetics and plant pathology by Walker. Others, like the short stimulating paper by Penrose, deal with a particular approach or piece of research.

The Jubilee Celebrations were intended as a survey of the work done in the fifty years from the "rediscovery" and of the perspectives for the future: this volume certainly achieves this purpose well and pleasantly.

G. PONTECORVO

GENES, PLANTS AND PEOPLE. *Essays on Genetics.* By C. D. Darlington and K. Mather. xxi + 187 pp. London: George Allen & Unwin. 16s.

This book is a symposium of the semi-technical writings of two geneticists at successive stages in the development of their thought. At the very least, it provides in compendious and accessible form a number of published papers