'leader stroke': and the 'main stroke', instead of proceeding from cathode to anode, proceeds from ground (positive) to cloud (negative). The discharge mechanism can start also from the anode at suitable field strengths. Here electron avalanches drawn into the anode leave positive space charges which virtually extend the anode towards the cathode. As the space charge here augments the main field, sparkover voltages for large gaps are lower for positive than for negative potentials. This explanation is in line with the explanations already offered for the different appearances of the rotating camera photographs of long sparks. Both authors present theories for the cause of stepping of the lightning leader stroke. Meek suggests this is due to ageing by recombination followed by rejuvenation. Loeb suggests it is due to replenishment of lost electrons in the avalanche process.

Chapter 3 is a valuable exposition of the many spark phenomena correlated by Meek's theory. A most important feature of the calculation is the value to be given to the ratio of main field to space-charge field for breakdown to ensue. A change in this ratio of 10 : 1 only alters the calculated breakdown voltage for a 1 cm. gap by 2 per cent, and the decision as to choice of ratio was taken on the 1 cm. gap breakdown voltage. This arbitrary choice is already the subject of criticism, and further development of spark theory will almost certainly depend on the physical significance of this ratio. The chapter has been extended somewhat in a recent paper by Meek (*J. Inst. Elect. Eng.*, **89**, 335, Aug. 1942), to which interested readers are referred.

The book is well written and most enjoyable. It is unfortunate that errors were not eliminated from the text, but that was due to the separation of the authors and their preoccupation with other urgent problems.

T. E. ALLIBONE.

DISCUSSING HEREDITY

Cytology, Genetics and Evolution

By M. Demerec, Charles W. Metz, Franz Schrader, Albert F. Blakeslee, Th. Dobzhansky, Clarence E. McClung, Herbert S. Jennings, William F. Diller, T. M. Sonneborn, Leon Churney, William R. Duryee, Paul S. Henshaw. (University of Pennsylvania: Bicentennial Conference.) Pp. v+168. (Philadelphia: University of Pennsylvania Press; London: Oxford University Press, 1941.) 12s. net.

THE second centenary of "The New Building" was celebrated, in more prosperous circumstances than the first, by holding a conference at Philadelphia, during September 15-21, 1940. A part of the proceedings of this conference seems to be included in the present volume. The editor's name is not mentioned; indeed, there is no introduction or preface. In default of any explanation the reviewer may perhaps attempt to fill the gap and place the papers in relationship.

To begin with, the last paper should properly come first. Henshaw's discussion of "Radiation and the Cell Nucleus" is a useful introduction to the physical side of the subject. Reference to the extensive recent American work on the biological side of the mechanism of X-ray breakage of chromosomes is, however, omitted. Jumping this gap we come to two articles on the physico-chemical structure of the cell and nucleus by Churney and Duryee. Duryee describes microdissection and other experiments with

the amphibian nucleus. Most striking is his study of the formation of nucleoli and his method of expelling the nucleolus from the nucleus by changing the pH of the medium. Some misconceptions could perhaps have been avoided by comparison with fixed and stained preparations.

Third should be taken two articles by Metz and Schrader on chromosome structure. Schrader has evidence that a fusion of heterochromatin is perhaps the basis of the second division pairing of sex chromosomes in the Heteroptera. He does not, however, recognize the relationship of such fusion with nucleolar fusion and its distinctness from the specific prophase association of homologous genes. The situation becomes clear only when plants and animals are considered together.

The next step is shown by Demerec's article on the "Nature of the Gene", which explains the evidence for the chromomere-gene equation. It also explains the connexion between observed breaks and exchanges in salivary gland chromosomes of *Drosophila*, and the physiological expression of genes. The fifth step is contained in Blakeslee's and Dobzhansky's accounts of the structural changes in chromosomes found to distinguish natural races in *Datura* and *Drosophila*. The situation is indeed widely different in the plant and the animal. But it is different, not because they are plants and animals, but because geographical isolation precedes differentiation in *Datura*, while it may or may not follow it in *Drosophila*. In the one, therefore, the segmental interchanges occur as accidents; in the other the segmental inversions occur as the condition of isolation— isolation first of segments of chromosomes, and later of individuals and races.

Next we arrive at a disconnected group of papers on Rhizopods and on the ciliated Protozoa. Sonneborn deals with the anomalous genetics, Diller with the anomalous cytology, of the relatives of *Paramecium*. It has to be admitted that the genetics cannot be satisfactorily considered until the cytological situation becomes clearer. Diller's comparative account, however, stands for a great advance, particularly in regard to the understanding of polyploidy and autogamy. A still further advance will come when the newer methods of recognizing nucleolar and nuclear constituents are applied to the group.

Finally comes an article by McClung on the "Evolution of the Germplasm". McClung presents an abstract of the problems that confronted Lamarck, Darwin and Weismann (whose names he does not mention), together with a mixture of the solutions they offered. The account is mystical and even in places meaningless. Many will regret that, while McClung's initial discovery of the sex-chromosomes has led his disciples forwards, it has apparently led him backwards to such a point as this.

We can gather that at the time these papers were written their authors did not know of the collection that was to be made of them, for only one cross-reference occurs in the book. This is a subject, or a group of subjects, in which above all cross-reference is needed at the present moment, and a symposium should provide precisely the means to this end. A year later the Cold Spring Harbor Symposium on Chromosomes and Genes (see *NATURE*, **149**, 242; 1942) achieved just this object and in doing so will prove itself an important milestone in the advance of biology. The present series of papers may be taken as an easy introduction to the larger work.

C. D. DARLINGTON.