is a contribution to constructive and unprejudiced thinking about the real issues. The argument, though not the philosophy of Lord Eustace Percy's lectures, has been stated fairly enough often before. It was well put in J. MacMurray's "Constructive Democracy", for example, where not only the necessity of government in a true democracy being under effective control was urged, but also the necessity of achieving industrial democracy in order that political democracy may survive. It may be true that, as MacMurray urges, the exclusion of the economic life from the competence of the political authority does not belong to the essence of democracy. Freedom of culture is, however, of the essence of democracy, and while conferences such as those recently held by the British Association and the Association of Scientific Workers show how men of science have awakened to the social implications of their work and are increasingly ready to recognize their responsibilities as citizens, the challenge to fundamental thought about the institutions of government, untrammelled by party inhibitions or tradition, thrown down directly and by implication in these papers is one which they, no less than others, have yet to meet.

THE FRAGMENTATION OF SCIENCE

Mitosis

The Movements of Chromosomes in Cell Division. By Prof. Franz Schrader. Pp. x+110. (New York: Columbia University Press; London: Oxford University Press, 1944.). 13*s*. 6*d*. net.

TWENTY years have passed since the appearance of Wilson's "Cell", that is of the third and all-embracing 1,200-page edition of this work. We may indeed take 1925 as the end of an epoch, the epoch of comprehensive description; always painstaking, usually thorough, and sometimes otiose, description. In the end this method collapsed of its own weight and broke into pieces. Since 1925 we have been busy putting the pieces together. There are many ways of doing this, most of them unprofitable, but some of them have given new structures of a kind not previously known in biology. Such, for example, is the genography based on the union of breeding analysis, X-ray breakage and salivary gland mapping. On the purely cytological side there is also the speculative structure based on a few simple observations of meiosis in polyploid plants, a structure on which we have been able to rest all our knowledge of genetic crossing-over as well as a large part of our knowledge of chromosome mechanics at meiosis and mitosis. Other special theoretical structures are arising, or will arise, from the new experimental methods of ultra-centrifuging, X-ray breakage, ultra-violet absorption spectroscopy, micro-incineration, specific enzyme treatments, and so on.

Such are the circumstances in which Prof. Schrader, Wilson's successor, takes up his pen to continue the work. Prof. Schrader, like his predecessor, is technically equipped for his task by a long and careful study of mitosis in certain Hemiptera. Theoretically he is equipped by his understanding of the change that has come over this field of research. He values highly the power of concentration in attack which the achievements of the last twenty years have demonstrated. His theme is mitosis, the division of the cell and the nucleus. In treating it he has taken great pains in limiting his objective and avoiding side issues. He has relegated the resting, prophase and telophase nuclei to a chapter of notes at the end of the book. He has likewise excluded the peculiarities of meiosis from his argument; and the evidence from sex-chromosome behaviour, which he himself summarized in 1928, and which a less self-denying critic might have been tempted to consider, is now grown too bulky or too awkward to take into account. The abnormalities of mitosis produced by cancer and by colchicine and X-ray treatments are sacrificed to the same economy. The uniformity of plants and the diversity of Protozoa (and here we may perhaps cavil) find no place. Genetics, chemistry and internal structure are all locked out or, one should say, thrown away, for they surely contain something of value for the study of mitosis.

After this generous clearance there is little left to distract us from the residue. This is simply the mitotic spindle and the centromere by which the chromosome is attached to this body, both of them stripped of their most significant variations. How does Prof. Schrader deal with this residue? Old-fashioned writers, like Wilson, have faced the same problem. They have first said what happened in mitosis, how it varied in Nature and could be changed in experiment, and have then drawn the conclusions and expounded the theories that seemed to combine or clarify these conditions. Schrader's method, however, is a new one. Having established the 'reality' of the spindle fibres as a basic assumption in two pages, he goes straight to general theories. The inevitably *a priori* theories of forty, fifty and sixty years ago occupy most of his attention, but the young ones also get their turn until liquid crystals and tactoids are reached. Throughout the discussion, observations and experiments appear only as the casual commentators, supporters or objectors, called in apparently to rectify the balance where some theory seems to be showing too badly or too well. For Prof. Schrader is utterly impartial. If one theory is obviously useless it is admitted to have helped in its time, and if another theory is obviously sound it is degraded to a truism or a mere exaggerated fact.

With such a tale the end would be foreseen, even if the author had not stated it on the first as well as on the last page. It is that his inquiry after the perfect and ultimate theory has failed. Mitosis is still too complicated, and the assault still too diffuse, for success. He feels "confusion", "humility", "disillusion" and a "despair" tempered only by hope that still further concentration in the attack (or, should he say, fragmentation in the objective?) may yet yield "definite promise of a final solution".

Prof. Schrader's book may seem depressing, and especially to those who know the merit of his purely descriptive work. But it is not entirely without value. It contains the lesson that while specialization in technique and material is necessary and profitable, specialization in theory, an arbitrary restriction of data, is a contradiction in itself. It is like mountaineering in manacles. That is why this book, on an immense subject, peters out into notes and trifles after seventy-five pages. In describing the past, and planning the future, of scientific theories we must consider all things before we choose to adopt or reject any of them; and in order to make that choice we must have a point of view, and perhaps even a theory, of our own. C. D. DARLINGTON.