The next two chapters are devoted to solvent and salt effects: these are matters of considerable subtlety where the subject is still growing, and raise issues of great theoretical interest, and in the first case of great practical importance. There are a brief final chapter on electrophilic catalysis and an addendum dealing with important matters which have arisen since 1961, the date to which the literature has been covered in the main text.

All students of physical organic chemistry will wish to study carefully the volume as a whole, and the greater part of it will be valuable to organic chemists generally, especially to third-year honours and first-year Ph.D. students.

N. B. CHAPMAN

CELLULAR ORGANIZATION

Funktionelle und Morphologische Organisation der Zelle

Wissenschaftliche Konferenz der Gesellschaft Deutscher Naturforscher und Ärzte in Rottach-Egern 1962. (9 Beiträge in Deutscher und 6 Beiträge in Englischer Sprache.) Pp. iv + 253. (Berlin, Göttingen and Heidelberg: Springer-Verlag, 1963.) 36 D.M.

FOR a long time the great issues of cellular organization have been argued in terms of the nucleus. The problem has been that of the relations of its physical structure, its chemical activity and its genetic permanence or continuity. Now, with the help of electron-microscopy, autoradiography and other techniques, the problem has, as we may say, boiled over into the rest of the cell. A wide range of results of this boiling over is displayed in the present symposium. A general statement of its purpose and its problems is, however, lacking.

It was the continuity and activity carried together by the nucleus which first struck the imagination of cytologists, German cytologists, in the nineteenth century. Clearly any structure in the cell which can achieve this difficult combination deserves to be given the status of an organella. Any body which can fulfil its short-term duties within the cell while meeting the long-term needs of propagation and distribution to different cells will thus qualify for this status. Presumably, therefore, any of the cell structures in which DNA is now beginning to be recognized will also qualify. How far will this property extend ?

The answer to this question has usually been derived in the past from the evidence of experiment, but experiment of the most varied kinds with the most varied organisms. The breeding of plants has shown us the self-propagation of the plastid. The embryology of animals has demonstrated the same property in the centrosome. The development of Protista has revealed the genetical continuity of their versatile fibre-forming organellæ. The evidence of immunology has left little doubt of a similar propagation in the higher animals. Here, and in the plasmagenes to be inferred from the heredity and development of the higher plants and animals, we do not know what particles or structures provide the basis of continuity. But in this symposium both the electron microscope and chemical analysis introduce us to a number of possible candidates for these duties.

No such central idea is, however, advanced to give unity to the present discussion. Nor is there indeed any central idea in biochemistry which might offer itself for such a purpose. The most nearly central problem is that which comes from the work of Mechelke and Beermann with the polytene chromosomes of flies. The connexion between heredity and development, and between DNA and RNA, revealed by these studies of development and differentiation, gives us a glimpse of what has long been suspected: the hierarchy of structures and functions which lie between the genetic code and its expression. It is a hierarchy which will require us more and more to study the cell as a system and to use all the available degrees of magnification in seeing how it has been built and organized. In order to succeed in this task we shall have to exploit our resources in more variety than is done in this symposium. Older and newer techniques will have to be more fully combined. Plants, omitted from this discussion, will not have to be left out. For it is already easy to see that, after the nucleus, their plastids will play the most important part in knitting our ideas together.

C. D. DARLINGTON

THE SENSES OF INSECTS

The Physiology of Insect Senses

By Prof. V. G. Dethier. (Methuen's Monographs on Biological Subjects.) Pp. ix + 266. (London: Methuen and Co., Ltd.; New York: John Wiley and Sons, Inc., 1963.) 42*s*. net.

THIRTY years have elapsed since Eltringham's monograph on *The Senses of Insects* was published in this series. At that time, the greater part of the modern work on insect sense organs had been done in Germany. This work received little reference in Eltringham's book, which presented the knowledge and ideas of an earlier epoch. J. D. Carthy dealt with the subject well in his *Introduction to the Behaviour of Invertebrates* some five years ago; but the new monograph by Prof. V. G. Dethier, although it covers again much of the same ground, is very welcome, for it is written by an author who has been personally involved in some of the most significant advances in our understanding of the chemical senses of insects.

The author deals at some length with those subjects which are most controversial at the present time: the nature of the action of chemostimulants at the receptive site, and the basis of their specificity; the interpretation of the electroretinogram; the varying spectral sensitivity in different insects, and the chemical nature of the photoreceptive substances; the mechanism in the insect eye which enables it to perceive the plane of polarized light; the physiological basis of the great differences which exist between different tactile hairs, depending on the purpose for which such receptors are used, that is, their diverse properties with respect to adaptation, and in the effect of direction of movement on the nervous discharges that result. In short, the emphasis throughout is on how insect sense organs work.

Advances in the past ten years, supported by electronic methods of neurophysiology and by structural investigations with the electron microscope, have been spectacular. From the studies of Slifer, in particular, we know that the thin cuticle which covers the chemoreceptive sensilla is perforated like a sieve and multiple fine dendrites in these perforations have their endings freely exposed to the atmosphere. We know, particularly from the work of Dethier and his school, that a single chemoreceptive hair on the tongue of the blowfly is receptive only at the extreme tip; the fly responds positively to stimulation of the hair by sugar, and by water, negatively to electrolytes, and to the mechanical displacement of the hair. Each of these perceptions is mediated by a separate dendrite and sense cell. From the work of Roeder and Treat we know that although the abdominal ears of the moth have only two neurones apiece, they can recognize both the character and the direction of the cries of a hunting bat.

Work done in all countries is well covered and a select list of about 700 titles is included. The extensive German work is well reviewed, including that dealing with insect vision. Our present lack of understanding in many parts of this subject is reflected in the obscurity of some of the