finding that excretion of cortisol 21-sulphate follows the oral administration, but not the intravenous infusion, of large doses of free cortisol. Vermeulen, examining the metabolism of certain anabolic steroids, finds that some testosterone derivatives decrease cortisol metabolism while others do not, and he puts forward the hypothesis that the difference in the two classes might depend on the route of excretion of the administered steroid. The feed-back theory which ordinarily accounts for the homœostatic control of plasma cortisol-levels is seen by James and Landon to be inadequate to explain the elevation of plasma cortisol in conditions of stress. They describe conditions under which stress will release adrenocorticotrophic hormone independently of the circulating steroid concentration. A chromatographic method using glass-fibre paper is described by De Hertogh *et al.* for the analysis of plasma cortisol, corticosterone and cortexolone. It should have a special interest for clinical biochemists.

Among other papers in the same section is one showing a difference between the *in vitro* and the *in vivo* incorporation of corticosteroid in sub-cellular particles of heart and kidney cortex; another indicates a synthetic route to aldosterone starting from the alkaloid holarrhimine. Aldosterone metabolism is dealt with by Pasqualini.

The final part of the volume is devoted to pathological considerations and includes an account of the metabolism of cortisol in Cushing's syndrome and of aldosterone in renal insufficiency. Cost evaluates urinary steroid excretion patterns and re-examines published ideas about the significance of 11-deoxycortisol compounds (compounds S and THS) in relation to the diagnosis of primary adrenocortical carcinoma. Combined histological and biochemical observations are the basis of Grant's paper on transformations accomplished by tissue taken from different zones of the adrenal cortex.

Those specially concerned with corticosteroids are bound to find some, but by no means all, papers in this volume meriting their close attention. J. Patterson

SYNAPTIC PHYSIOLOGY

The Physiology of Synapses

By Prof. John Carew Eccles. Pp. xi+316. (Berlin: Springer-Verlag, 1964.) 36 D.M.

THE understanding of nervous activity depends on our grasp ot two matters, the pattern of interconnexion between cells and cell masses, and functional result in a given cell of the arrival of activity at any particular presynaptic ending. The microanatomy of the nervous system got off to an early and propitious start largely due to the brilliance of Cajal, and although many details of nervous anatomy remain obscure the basic patterns have been known for nearly half a century. On the other hand, the study of synaptic events remained unproductive until the discovery of the intermediary local synaptic potential at the neuromuscular junction. There followed the development of precise biophysical methods for recording synaptic events and for analysing the site and mechanism of action. The main object of this book is to present a critical account of the synaptic areas so far investigated. One of the features discussed is whether transmission is due solely to local current flow or whether it involves the mediation of chemical agents, and Eccles describes the criteria that must be used to make this distinction. While the evidence points conclusively to the chemical nature of the majority of synapses, there is now equally conclusive evidence that some synapses are purely electrical, and there is even an interesting dual mechanism in the ciliary ganglion of the chick in which both processes may play a part. Perhaps one of the most interesting findings in recent years is that, while there is considerable stereotypy in synaptic patterns (for example, the post-junctional effects of all the chemically mediated excitatory junctions appear very similar), there is also available a considerable variety of synaptic types, so that similar final effects may be produced by unrelated mechanisms. For example, inhibition may be produced by a direct action of an inhibitory transmitter on the post-synaptic membrane, causing increased chloride permeability, or it may be produced presynaptically by depolarization of the presynaptic excitatory fibre, thus depressing its ability to release excitatory transmitter. While both these processes will, for example, depress the response of anterior horn cells to primary excitatory afferents, the net result is significantly different. In the first case the inhibiting post-synaptic potential is competitive with all incoming excitatory impulses; but in the second case, because the effect is produced presynaptically, no interference occurs other than with excitation from the presynaptic fibre that is affected. In other words, the second process is a much more selective one. This kind of distinction may have considerable significance in overall nervous integration. One of the most interesting of the newer functional processes is the electrical inhibitory synapse on the Mauthner's cell of goldfish, discovered by Furukawa and Furshpan. In this instance the presynaptic fibre is coiled around the axon hillock of the Mauthner cell and acts as an external source of hyperpolarizing current. In some respects this is reminiscent of the old hypothesis of inhibition by currents generated by Golgi Type II cells. In contrast to the precision with which post-synaptic events can be measured and the mechanisms of the membrane changes delineated by ion injection and by passage of current, our knowledge of presynaptic processes seems meagre. It is probable that transmitter release is highly dependent on membrane depolarization at the terminals, but how this effects release is obscure. The main reason for this deficiency lies in the great technical difficulties in the way of carrying out direct investigations on presynaptic fibres owing to their small size. An even greater disappointment to all interested in synaptic physiology has been the failure to elucidate the nature of any chemical transmitter in the mammalian nervous system other than acetylcholine. It is a sorry situation that despite considerable effort we are totally in the dark as to the chemical transmitter at the primary sensory afferent fibres, and both presynaptic and post-synaptic spinal cord inhibitory systems, not to mention other areas. Sooner or later one hopes that the blunderbuss approach being pursued at present will lead to a breakthrough, but there is really little sign of this so far. Another area in which the result has not been dramatic is the investigation of synaptic plasticity, although this is a vital topic for the understanding of the developing nervous system. The rapid advance in the understanding of synaptic processes has not as yet had much impact on the examination of complex neurophysiological or behavioural phenomena, mainly because there are so many problems of organization still to be solved, but it is surely only the faint-hearted who are not convinced that exact descriptions of such processes are now feasible. Indeed, for all who are interested in the analysis of nervous processes this learned and lucid book is indispensable, and will remain so until superseded by Eccles's next book.

A. S. V. Burgen

CARBOHYDRATE CHEMISTRY AND BIOCHEMISTRY

Advances in Carbohydrate Chemistry

Vol. 18. Edited by Melville L. Wolfrom and R. Stuart Tipson. Pp. xi+456. (New York and London: Academic Press, 1963.) 118*s*.

WHATEVER his or her specialization, every carbohydrate chemist or biochemist will find something of direct interest in the latest edition of this standard