

colleague Weigle lies essentially in the contributions they made using single protein antigens. This led to a clearer definition of the experimental circumstances involved in the induction, maintenance and termination of the unresponsive state not only in the neonate but also in adult animals. The account of this work given by Weigle in his monograph will not provide easy reading for the general immunologist owing to the excessive wealth of experimental detail. Nonetheless, the specialist in this field will find it of value to have the data collected in one volume.

The author's important studies on the termination of natural or artificially acquired unresponsiveness by cross-reacting antigens feature prominently; his results indicate that antibodies to the tolerance-inducing antigen evoked in this way react only with determinants similar to those present on the cross-reacting antigen but not with determinants to which tolerance has already been established. This conclusion has since been elegantly supported by the findings of Paul, Siskind and Benacerraf (*Immunology*, 13, 147; 1967), who studied the termination of unresponsiveness to human serum albumin (HSA) by injection of dinitrophenyl-HSA; the antibodies purified by adsorption to and elution from HSA had a much higher affinity for dinitrophenyl-HSA than for the unconjugated albumin. Weigle's caution in referring to "termination of the unresponsive state" rather than "abrogation of tolerance" is thus entirely justified. Demonstration of the latter phenomenon, by providing evidence for the survival of tolerant cells, would have helped to clarify the fundamental question of whether unresponsiveness involves merely the inhibition of lymphoid cells or their elimination.

The author clearly considers that in the present state of knowledge extensive theoretical considerations are not warranted, but nevertheless some useful generalizations are made. He stresses the need for adequate equilibration of antigen between intra- and extra-vascular spaces for the successful induction of tolerance and directs attention to the fact that all manipulations which facilitate induction of unresponsiveness such as neonatal injection or X-irradiation also provide conditions in which the initial antibody response is depressed; he suggests that antigen can thereby persist at concentrations adequate to inhibit or eliminate the appropriate lymphoid cells. The interesting conclusion is drawn that the inhibitory effect of simultaneous injection of the tolerogenic antigen on the termination of unresponsiveness by cross-reacting antigen provides a mechanism by which the body is protected from the formation of autoantibodies by cross-reacting microbial antigens. Where the concentration of a body constituent in the circulation is low, one could expect, and indeed may find, formation of autoantibodies in response to such exogenous antigens. Weigle speculates that this may be one of the ways in which autoimmune diseases arise, but could have been more explicit in relating this hypothesis to specific clinical disorders. The relevance of tolerance induction in the adult to problems of transplantation should perhaps have been discussed in a book on this subject, and in this context the possible implications of Mitchison's observations on "low dose tolerance" would seem to merit greater emphasis. I. M. ROITT

INSECT PHYSIOLOGY

Insects and Physiology

Edited by J. W. L. Beament and J. E. Treherne. Pp. viii + 378 + 34 plates. (Edinburgh and London: Oliver and Boyd, Ltd., 1967.) 130s.

THE greatness of a man of science is not measured by the number of his pupils, the weight of his publications or even the number of times his name appears in textbooks. Professor V. B. Wigglesworth would qualify on any of these counts, but none would do him justice. The

true measure of greatness is the extent to which others have been able to build, on foundations securely laid, a structure of greater beauty than the founder himself could have created.

This book is a collection of articles specially written on the main theme of Wigglesworth's 1948 Croonian Lecture—the suitability of insects for the study of physiology. The authors are all people who have worked at least for a time in his unit in Cambridge. As is almost inevitable in such a publication, the standard varies widely, and it is depressing to note that the main flowering of ideas seems at present to be taking place on the other side of the Atlantic. The four essays from Western Reserve University are all extremely stimulating and so are five others from elsewhere in the United States and Canada; many of these record important new experimental results. By contrast (and apart from those by Maddrell and Weis-Fogh), the articles from Cambridge are mainly historical or repeat discussions already published elsewhere. Migration appears to be desirable for the health of this species, though the quality of the writing by Miller shows that it need not be to another country.

Wigglesworth has worked on insects for most of his life, but he has always tried to relate his discoveries to the rest of physiology. Another distinction can be made between the different articles in this volume by the extent to which the authors follow their mentor's example. Most of the Americans show a clear appreciation of the fact that insects are merely one of the types of animal and thus strengthen their advocacy of this particular biological material for the solution of their problems. Some of the local products seem to be entomologists first and physiologists second, and a few do not appear even to be familiar with the recent entomological literature.

The main subjects discussed are morphogenesis, neurosecretion, the growth and organization of the sensory and central nervous systems and the structure and permeability of the cuticle. The foundations for each of these branches of insect physiology were laid by Wigglesworth. The reviews by Weis-Fogh on flight metabolism, by Berridge on ion and water transport and by Davey on reproductive physiology are also important, though drawing only general inspiration from his writings; these three bring out very well the value of studies on insects for the general physiologist. Although, as Miller says, "reviews and hypotheses, like nappies, must be freely disposable", many of these articles will certainly remain in use for some time and many of the suggestions made by the authors will justify several passages through the clarifying laundries of the scientific world. I fear that because the word "insects" is printed large and the word "physiology" small on the dust cover and spine, many physiologists will miss the opportunity offered to them, for the crusade launched by Wigglesworth in 1948 still hardly affects the security of the great para-medical laboratories. Perhaps David Smith puts his finger on the reason for this when he writes that, for all the many advantages of insects, "their small size hampers correlated structural and biochemical studies involving the separation of subcellular fractions". Certainly the attempts made in this volume to jump on the DNA/RNA band-wagon reveal a singular lack of secure footholds.

I must regretfully note certain signs of carelessness in printing and editing. There are minor misprints in nearly every article and in several places the initial letter of a line has fallen out; once the initial words on two adjacent lines are interchanged. And surely one contributor should not be allowed to mis-spell the name of another in his text and list of references! For all this, the volume is a worthy tribute to a great man and one may hope that this evidence of the progress made by some of his pupils and collaborators will be to him both a source of satisfaction and an encouragement to continue his own researches, which are by no means at an end.

J. W. S. PRINGLE