expected in the account of a Josiah Macy conference, for the proceedings are always reported verbatim. Even the opening speakers are interrupted, and the ensuing arguments and interjections are often somewhat chaotic and may be very irritating to the seeker after knowledge. Nevertheless, there is a great deal of real information in this book in spite of the sense of difficulty and ignorance which pervades the whole issue. Great though the men may be who pioneered so triumphantly the promotion and control of atomic fission, perhaps they had a simpler problem to solve than these biologists. R. A. McCANCE

IMMUNOLOGY: RESEARCH AND TEACHING

Lectures in Immunochemistry

By Prof. Michael Heidelberger. Pp. x+150. (New York: Academic Press, Inc.; London: Academic Books, Ltd., 1956.) 4 dollars.

Fundamentals of Immunology

By Prof. William C. Boyd. Third edition, completely revised and rewritten. Pp. xiv+776. (New York: Interscience Publishers, Inc.; London: Interscience Publishers, Ltd., 1956.) 10 dollars.

Immunology and Serology

By Prof. Philip L. Carpenter. Pp. viii+351. (Philadelphia and London: W. B. Saunders Company, 1956.) 45s. 6d.

IMMUNOCHEMISTRY, as Kabat and Mayer wrote in 1952, "has of recent years become a discipline in its own right due largely to the development of precise analytical chemical methods for measurement of both antigens and antibodies". No one has done more than Heidelberger in this development of precise methods; the extent of his contribution can be gauged from the number of times that his work is quoted in Boyd's "Fundamentals of Immunology". He has now published six lectures given in Tokyo in 1955, together with three others. On the whole, the book is disappointing, whether as a review of the development of immunochemistry, of Heidelberger's own work or of the present state of immunochemistry. It gives no indication of the extent to which the work on proteins, particularly that of Svedberg, prepared the ground during the 1920's for the view that antibodies are distinct proteins present in antisera in measurable amounts. Although the book includes a chapter on the relations between chemical constitution and immunological specificity, Landsteiner is nowhere mentioned, although his work beginning before 1917 had been the chief influence in dispelling hazy ideas about specificity.

The presentation of the present state of the theory of the formation of precipitates is incomplete. Once it was agreed that antibody molecules have more than one combining site or 'valency', it was obvious that antibody and antigen, if present in suitable ratios, would build up aggregates held together by specific bonds. But that is not the whole story; for this specific aggregation does not account for the formation of precipitates in extreme antibody excess, and it is not altogether certain whether it, alone, accounts for the formation of precipitates at all.

Boyd's book is "an introduction to the science of immunology". The subject of its first half may be regarded as immunochemistry; that is, the nature

of the substances involved in immunity and their interactions. It gives a full and fair account of modern knowledge; its length is justified by the need to know the substances involved and how they behave in order to understand the reactions in the living animal. Boyd now accepts the proofs that antibodies may have more than one valency, and that antigens and antibodies may build large aggregates linked by specific valencies. But his pp. 336-342 still include equations—relating the antibody/antigen ratio in the precipitates to proportions in which antibody and antigen are mixed—that assume that antibody is univalent; equations also that, unlike that of Heidelberger and Kendall, include arbitrary parameters, and do not express some of the most characteristic features of the precipitin curve.

The second part of the book is more clinical and deals with such subjects as hypersensitivity, auto-immunization and disease and immunity in action. As is inevitable when such a wide field is covered, any reader may find some detail of classification or emphasis with which he disagrees; and the presentation tends occasionally to degenerate into a list of observations and opinions with little criticism of the soundness of methods or the adequacy of grounds for opinion. But the references are there and the reader can look up the originals and draw his own conclusions.

The book ends with a chapter on laboratory methods. Two criticisms may be made. Serological methods are being applied more and more to matters outside immunity; more warning might have been given about difficulties and fallacies. Serology is not all plain sailing; it may be difficult to get antibodies against a particular antigen, and any antibody one gets may be against an impurity. Boyd might have quoted, as an example, the experiences of Cohn and colleagues and of Borduas and Grabar with ovalbumin and conalbumin. Also more might have been said about the newer techniques that are becoming popular; for example, the red-cell sensitization technique, which is merely mentioned, and the tanned-cell method, which is not mentioned at all. One can find the technique of the Wassermann reaction in many books, but not these and the Ouchterlony and Oudin methods.

Although this book will prove indispensable for research workers and advanced students, it would not help medical students and practitioners; there is too much controversial detail.

A better book for non-specialists is Carpenter's "Immunology and Serology". The author gives a clear and balanced account of modern knowledge and theories of serology. He admits that he has placed greater emphasis on serology, "partly because more is known about it". In fact, "Infection and Immunity" and "Antiviral Immunity" together get only twenty-nine pages out of the total 351; both "Allergy" and "Experiments in Serology" get as many pages. Although these twenty-nine pages give most of what is known about the defences of the individual (as opposed to external influences which should be classed under hygiene), more might have been written about the values of immunization against typhoid and pneumonia (both of which Boyd mentions) and against whooping cough, and about the role of antibodies in protection against these diseases. Discussions of protection by Salk vaccine and by diphtheria toxoid are included.

J. R. MARRACK