approach of such fundamental importance that no microbiologist can afford to neglect its advantages.

So to the Proceedings of the 6th Symposium. The book contains 25 contributions, many of which are orientated towards industrial applications; it also indicates to the microbiological world at large the other areas in which exploitation of the technique is proving advantageous. Seven chapters are devoted to aspects of single-cell protein (SCP) production and cover such topics as the use of waste material as fermentation substrates and process design based on mixed bacterial cultures. A particularly stimulating analysis of carbohydrate versus hydrocarbon feedstocks for SCP production is contributed by D. G. MacLennan who develops some compelling arguments for the use of the former based on the criteria of economics and product acceptability. Other matters covered in this applied section are enzyme production and continuous brewing processes. A few chapters are devoted to more fundamental questions of metabolic regulation in micro-organisms, again emphasising the benefits that follow from the use of continuous culture, while a novel feature of this volume is the discussion of continuous culture in the context of microbiology teaching. The final sequence of chapters is concerned with the interaction of micro-organisms and the environment and will be of major interest to microbial ecologists. The topics considered here are diverse and fascinating and include modelling of oral and river populations in chemostats, the utilisation of mixed homologous substrates, and analyses of mixed cultures.

These symposia have also been of immense value in the continuing development and extension of continuous culture theory, and "Continuous Culture 6" is no exception. Two chapters are particularly noteworthy in this context. In the first, Denis Herbert, taking his cue from the design of SCP fermentations, presents an excellent discussion of the stoichiometry of microbial growth. This essay is essential reading not only for those engaged in SCP production but for all microbiologists concerned with basic problems in growth physiology. In a similar way the contribution from Tempest and Neijssel on microbial adaptation to low nutrient environments contains much conceptually important material. The volume concludes with the editors, as is their wont, interpolating a few well-timed ex-cathedra statements on matters such as relative growth rates.

This book is an essential library acquisition and many microbiologists will wish to have their personal copy. Unfortunately its price is disappointingly high, particularly in view of the off-set litho production used and, whereas students could be cajoled into purchasing previous volumes in the series, most teachers will be reluctant to make the attempt with this one. As a final point one is left with the question of how much longer these Continuous Culture Symposia might or should be continued as separate specialist meetings. Has continuous culture eventually arrived on the scene and is it now fully integrated into microbiology as a whole? The contents of "Continuous Culture 6" suggest that we are rapidly approaching a state of affairs in which the answer is in the affirmative.

A. T. BULL

Immunology of the gut

This is a splendid volume which takes the subject of gastro-intestinal immunology out of the world of near folk-lore to the status of a respectable science. Furthermore, at a time when readers have been inundated with new books on immunology, it achieves the almost miraculous task of saying something novel and timely on an immunological topic. The best parts of the book are those that review the basic immunology of the gut. These include the contributions by Brandtzaeg and Cebra concerning the secretory IgA system and the chapter by Gowans and his colleagues on the physiology of IgA-producing cells. Particularly difficult problems to resolve have been the mechanisms that limit the absorption of immunogenic material, the extent to which absorption occurs in the normal gut and the
biological significance of circulating antibodies to dietary antigens. Ahlstedt's review of these subjects is impressive and authoritative. There is a ample consideration of host defence to parasitic and other gut infections; it has, for example, long been a conundrum that IgE and eosinophils are hall-marks of allergic reactions yet are clearly part of the reaction to such infections. Mayrhofer and Beeson each lay the foundations for a detailed consideration of the control of immune reactions that on the one hand limit the extent of microbial invasion, and on the other can damage the gut. Thus it is felicitous that the book includes Rosen's description of gut disorders in immunodeficiency and Seligman's account of alpha-chain disease as these disorders provide vital clues to the regulatory processes whose breakdown initiates allergic disease. There is an impressive attempt to provide a logical continuity between basic immunology and the immunology of common diseases such as coeliac disease and ulcerative colitis. These sections are most successful when the contributors have attempted a slow but purposeful progression from physiological analysis to disease phenomena. A good example is Anne Ferguson's description of how simple animal models can be adapted for research on coeliac disease. In contrast those sections based on uninterpretable clinical observations are less successful, especially when clouded by speculation that transcends the meagre data available. It is sobering to reflect that Dicke's simple observations, made in 1950, about the relation between coeliac disease and gluten has given us 90% of the total useful knowledge concerning the pathogenesis of the disorder derived in three decades of intense effort.

This is a splendid book for the clinician, scientist or microbiologist who wants to appreciate the direction of modern thought about gut immunology and immunopathology. For a change, the lengthy discussion sections help in this regard. Indeed, it would be a positive advantage not to have read most earlier tracts on the subject. It is not a textbook and is certainly too stimulating and refreshing to have any value for examination candidates. The only prerequisites are an unbiased mind and familiarity with a simple introductory text on immunology.

A. M. DENMAN

The specificity and action of animal, bacterial and plant toxins

This book summarises recent advances in knowledge of the nature and mechanism of action of a group of well characterised toxins. Cuatrecasas aims to focus the reader's attention not on the disease-causing properties of these toxins but on their potential value as probes of membrane structure and function and cell physiology. Most of the toxins dealt with are bacterial products (cholera toxin, diphtheria toxin, the lethal toxin of Pseudomonas aeruginosa, tetanus toxin, botulinum toxin, the cytolytic toxins and colicin E3). However, there is a chapter on the plant toxins abrin and ricin, and two animal toxins, β-bungarotoxin and batrachotoxin, are also included. Each contribution is a detailed critical review prepared by an expert in the field.

One of the main themes is that several toxins, especially cholera toxin, diphtheria toxin, colicin E3 and the plant toxins abrin and ricin (from the seeds of the legumeAbrus precatorius and the castor bean plant Ricinus communis, respectively, exhibit common features. They bind to specific receptors on the surfaces of susceptible cells and, after a lag period during which toxin-receptor complexes probably move in the lateral plane of the membrane, penetrate the membrane to act on their specific target sites. Most of these toxins are also similar in that their molecules consist of separable regions, a binding site and an active (toxic) site. The usefulness of radiolabelled toxin with high specific activity to study binding is emphasised, as are the problems of identifying specific receptors. The receptor for diphtheria toxin for instance has not yet been identified because there are few binding sites per cell. The least well-understood aspect of the action of these toxins is clearly the mechanism of penetration through the cell membrane.