The book gives a clear and interesting summary of the hormonal control of differentiation and growth and the experimental procedures which are used in investigating this subject. The text can be understood without any previous specialised knowledge and the review will be most useful to biologists who require a simple introduction to the subject. The student interested in problems of growth differentiation and genetic assimilation will find much of value in this little book, but should not be misled by the word " Polymorphism " (the title of chapter 5) into believing that the subject is covered in this book. In the reviewer's opinion, the title of this particular chapter should have been " Genotype-Environment Interaction ".

P. M. SHEPPARD.

PROTEIN BIOSYNTHESIS. Ed. R. J. C. Harris. London: Academic Press. 1961. Pp. 409. 95s.

This symposium was held in the Netherlands in August 1960, and representatives of most of the major groups working on protein biosynthesis were present. The quality of their contributions (to judge from the published work) was in general high, but unfortunately a few are here presented in almost abstract form.

For those not familiar with the general outline of current ideas on protein biosynthesis, most of the articles have a brief introduction, but Koningsberger's article on yeast and McQuillen's on *Escherichia coli* provide the best starting points. Both review the events in a particular organism, the former concentrating on the amino acid activation and the latter on the events occurring on the ribosomes. Though it is generally accepted that amino-acids can be activated by formation of adenosyl derivatives, that the amino-acyl part of these can be transferred to soluble ribonucleic acid molecules which form up on the ribonucleic acid of the endoplasmic reticulum and that the amino-acids can ultimately be released as new protein, both these (and other) contributors suggest caution in designating this the only or even the major route. It is, of course, true that much of the evidence comes from adaptive enzyme synthesis or formation of " export" protein (*e.g.* serum albumin), but where the formation of soluble constitutive enzymes such as the pyruvic kinase or aldolase in peas (Webster and Lingrel) has been studied it has been found to be similar. However, in mitochondria (Roodyn, Reis and Work) there is no evidence of ribosomal particles and the amount of ribonucleic acid is low, though the amino-acid activating enzymes are present and protein is synthesised.

Even if one accepts the outline of events (and many of the papers in this symposium provide convincing evidence), many problems remain. Thus each amino-acid has its own activating system (many of which have been isolated) and each is transferred to a specific ribonucleic acid. These specific acceptors are difficult to separate and Zamecnik, Stephenson and Yu discuss a proposed method for this and for attempting to determine what confers the specificity. The situation is indeed more complex as Bosch *et al.* show that the soluble ribonucleic acid can be separated into four fractions only one of which they believe to be carrier and which reacts with only one of three components found in the microsomal ribonucleic acid.

The distinction between microsomal and ribosomal preparations is that the former have parts of the membrane attached to the ribonucleoprotein particles that constitute the latter and several contributors suggest

that this membrane may be important in protein synthesis particularly in mammalian systems where microsomal preparations have most often been used. Butler, Godson and Hunter even suggest that the membrane phospholipid is complexed with amino-acids to form a direct precursor of protein in *Bacillus megatherium* protoplasts, but McQuillen found no evidence to support this in his experiments in *Escherichia coli*.

Gross and Naomo report experiments on modification of enzyme structure by the inhibitor 5-fluorouracil and the accumulation under these conditions of a ribonucleic acid other than soluble or microsomal RNA. It is tempting to speculate that this is the messenger RNA transferring information from nucleus to ribosome, but the only definite conclusion is that here is yet another fraction for which we have to find the function and that as yet we have only the barest possible biochemical outline of protein synthesis. Indeed perhaps the most important aspect of this symposium is the note of caution in most of the contributions that we may not yet be studying the systems most important *in vivo*.

Any macromolecule is the end-product of a series of processes and although polymerisation of the constituent monomers followed by specific folding or coiling of the polymer may be thought of as the synthetic mechanism these reactions are subject to both physiological and genetic control and the molecule itself must ultimately be built into the fabric of the cell. For protein it is difficult to divorce the genetic control from the actual polymerisation reaction and it is regretted that this symposium contained no contributions on this aspect of the subject.

One would have liked to have had more information on the biological problems (as opposed to the biochemical ones) which Siekevitz enumerates in his brief introductory article, for, as he says " in the final analysis we are not interested in the problem of protein synthesis *per se* but in how these synthesised proteins can . . . form the various morphological structures which constitute the biochemistry of the cell ".

The book does, however, present a comprehensive survey of current research and hypothesis on the mechanism by which amino-acids are condensed to form polypeptide in a variety of animal, plant, and bacterial cells. The editor and publishers are to be congratulated on having produced (to the usual high standards of Academic Press) such a worthwhile report within nine months of the proceedings. K. W. FULLER.

MACROMOLECULAR COMPLEXES. Ed. by M. V. Edds, Jr. New York: Ronald Press. 1961. Pp. 257. $7.00.

This book contains nine papers on the organisation of macromolecules read at the sixth annual symposium of the Society of General Physiologists meeting at Illinois in 1959. At the end of each article there is an edited version of the discussion of the paper and there is a common index, which is too short to be useful. This kind of book must be judged for its value to the non-specialist reader, for the data must be at least two years out of date by the time of its publication and most of the work will by then have appeared elsewhere.

There is an introductory paper by Waugh on the formation of fibrils of insulin and of spherical micelles of casein. The other articles concern tropacollagen polymerisation (Hodge and Schmitt), deposition of apatite in collagen (Glimcher), the use of liquid helium in work on lamellar systems