All in all, the book is clearly written and concise, and it has good numerical examples dispersed throughout as well as problems at the end of each chapter.

But one is left wondering about the pedagogical problem—do prospective students really obtain the best introduction to chemical engineering from a textbook in which a multitude of topics are introduced or should students be given thorough fundamentals and applications in separate courses in thermodynamics, chemical kinetics, and mathematics (including numerical analysis and computer techniques)? Should the first introductory course in chemical engineering be restricted to elements of the energy and material balance, including stoichiometry, and the other subjects left to subsequent courses?

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Constituents of Life

Comparative Biochemistry. A comprehensive treatise. vol. 4, pt. B, *Constituents of Life*. Marcel Florkin and Howard S. Mason, Eds. Academic Press, New York, 1962. xxiii + 841 pp. Illus. $26.

Volume 4 of this encyclopedic series opens with T. L. V. Ulbricht's stimulating discussion of the fundamental aspects of the optical asymmetry of metabolites. It is gratifying to note that Kögl's work is discussed in its true perspective.

The chapter on cellulose, starch, and glycogen (by J. S. Brimacombe and M. Stacey) provides an up-to-date review of this aspect of comparative biochemistry. F. F. Nord and W. J. Schubert have compiled an account of the biochemistry of lignin formation, from which it is apparent that our knowledge of this process is quite fragmentary, despite the tremendous amount of research that has been carried out in this field. Nature can be very reluctant to unveil its secrets!

G. Brawerman and H. S. Shapiro have assembled a wealth of information in the chapter that deals with nucleic acids. The unique occurrence of cytoplasmic DNA-containing particles (kappa and lambda) in certain strains of *Paramecium aurelia* was overlooked, however. The evaluation of variations in the protein molecule, especially when viewed in the framework of the phyletic position these biomacromolecules occupy, and of their possible role in evolution at the molecular level forms the basis of the thought-provoking chapter, "Protein molecules: Intra-specific and interspecific variations" by A. Vegotsky and S. W. Fox. The comparative aspects of the metabolism of aromatic amino acids (L. M. Henderson, R. H. Gholson, and C. E. Dalgliesh) are lucidly treated in a review that includes more than 500 references.

The next three chapters (on structural and chemical properties of keratin-forming tissue by A. G. Matoltsy, sclerotization by M. G. M. Pryor, and silk and other cocoon proteins by K. M. Rudall) present discussions of three important classes of biomacromolecules. The capacity of a single enzyme system to allow the heterotypic expression of traits that are associated with the development of a different character in various organisms is truly fascinating. These traits include the formation of an exoskeleton, of protective tissues, and of fibrous materials essential for the propagation and the preservation of species. The fact that similar mechanisms occur in the formation of flower pigments, flavonoids, melanins, and lignins, as well as in the pigmentation of the teguments, feathers, scales, hair, and eyes of chordates leads us to believe that nature is simple indeed and that the economy of tools may be looked upon as an essential feature of all living systems [H. A. Krebs, *British Medical Bulletin* **9**, 92 (1953)].

The chapter on blood coagulation (by C. Grégoire and H. J. Tagnon) is concerned with a polymerization process of prime significance in the homeostatic processes and, consequently, in the preservation of the vertebrate body. In the chapter on metamorphosis and chemical adaptation in amphibia, T. P. Bennet and E. Frieden summarize the biochemical data available on this subject and discuss the protein transformations during amphibian metamorphosis. The following three chapters (on the structure, distribution, and metabolism of porphyrins by C. Rimington and G. Y. Kennedy, the structure and metabolism of pteridines by H. S. Forrest, and the structure, distribution, and function of carotenoids by T. W. Goodwin) continue the discussion of polymerization processes that operate in the formation of compounds which are of great importance for life under earthly conditions. The volume closes with H. B. Steinbach's fine discussion of the comparative aspects of the biochemistry of alkali metals.

Twelve of this volume's 15 chapters are concerned with nature's important polymers and polymerization processes; thus, volume 4 presents a continuity that is lacking in volume 3 [reviewed in *Science* **137**, 745 1962)]. Although the editors were confronted with serious difficulties in insuring publication without delay, it would have been much more preferable to follow the original plan of organization. If chapters 7 (on natural saccharides and oligosaccharides), 10 and 11 (on the structure, distribution, and metabolism of terpenoids), and 12 and 13 (on quinones and melanins) published in volume 3 had been combined with the 12 chapters mentioned above, a volume of unique continuity would have resulted.

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Transition Metal Chemistry

Introduction to Ligand Field Theory. Carl J. Ballhausen. McGraw-Hill, New York, 1962. ix + 298 pp. Illus. $11.75.

Ligand field theory, a theory of the electronic structures, atomic configurations, spectra, and magnetic properties of transition element coordination complexes, has become highly fashionable only in the last decade, but in fact (at least with respect to the crystal field theory contained in it) the theory dates back to Becquerel's and Bethe's famous papers in 1929 and to the important contributions made by Kramers, van Vleck, and others a little later. A book which represents the present state of the subject and which is written by one of the principal contributors to its recent development and applications will be welcomed by those who work in the field and by those who only wish to learn something about it. Such a book was indeed overdue. The only previous work that covered comparable ground, Griffith's *The Theory of Transition Metal Ions* (1961), is possibly too formidable for any but true *aficionados*. Orgel's *An Introduction to Transition*