exemplary objectivity of the social forces generated by colonialism, nationalism, and even apartheid.

The heart of what Herskovits has to say follows an introductory survey of the aboriginal culture areas of Africa south of the Sahara. In this connection, he considers how and why it is that Africans with agricultural traditions now control the dynamic forces about which he writes. The ensuing pages of *The Human Factor* bring a truly fresh approach to the literature on Africa. Even the well-read will find both new material and new insights into what they already know. In basic design, successive chapters set the scene of human relations within which a series of dramas of culture change takes place. Thus one chapter, "The land," covers the aboriginal meaning of the native earth. Starting with these values, we are led through a still incomplete series of adjustments to pressures on the land, first by Europeans and now by Africans themselves.

Some areas of knowledge about Africa, which were heretofore the domain of a few specialists, achieve just recognition. The chapter entitled "The Book" is an unusual anthropological discussion of Islam and Christianity, through their varying fortunes down to their implications for the present. In "The school" another stepchild of the anthropologist is treated in such a way that enrollment figures are subordinated to the fundamental problems of adapting European educational institutions to the divergent motivations and needs of new Africa.

In the same vein, the focus shifts to other situations and institutions within which traditional lifeways are being reshaped as the old colonies drive toward self-fulfillment. But the politics of nationalism is not handled as a matter of political parties and governmental structures. It is a story of new values, their struggle for expression, and the distinctively African form they achieve. Even economic change is not seen in terms of new industries and gross national products, but is dealt with in terms of working people—labor incentives, work rhythms, and trade unions hybridized in transplantation.

The text is true to its title; the pages deal with people facing problems rooted in African culture and African experience. To read the book is to grow in understanding.

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Bone-Seeking Elements

Radioisotopes and Bone. A symposium organized by the Council for International Organizations for Medical Sciences. Franklin C. McLean, Pierre LaCroix, and Ann M. Budy, Eds. Davis, Philadelphia, 1962. xxiii + 522 pp. Illus. $15.

The evolution of bone, some 400 million years ago, gave the vertebrates physical and biochemical superiority over the other animals, but in our time mineralized tissue can be a serious liability. Bone tissue removes harmful radioactive substances from the tissue fluid and circulating blood and concentrates them in the center of the body around the organs of blood formation. Bone is the storage element for a servo or closed-cycle system composed of highly specialized connective tissue cells that are subject to radiation damage and malignant degeneration. But there is a happy side to the subject, and that is all recounted in this book.

Radioisotopes are responsible for many important advances in our knowledge of the normal and pathological physiology of the skeletal system. This book, *Radioisotopes and Bone,* is primarily designed for active investigators working in the fields of physiology and biochemistry. Between 29 August and 2 September 1960, 47 scientists met (at Princeton, New Jersey) to pool information on and discuss terminology or theory of bone-seeking elements. The book consists of 26 scientific reports including valuable tables of data and many new illustrations. The 15-page bibliography, at the end of the book, lists nearly all of the original literature published during the past 25 years.

The rate at which scientists are working on bone exceeds the present rate at which research findings are published between hard covers. Within a very short time, some articles are superseded by additional work, but some of those in this book are original contributions not published elsewhere.

Four chapters cover the kinetics of calcium metabolism, the mechanisms of calcium homeostasis in experimental animals, and patients with various disorders of bone. Ten chapters deal with the morphology and histophysiology of bone, observed with the aid of autoradiographical techniques. There are single articles on the use of C^{14}-proline for observing the synthesis of protein of bone matrix; H^3-thymidine for labeling the nuclei of cartilage and bone cells; C^{14}-labeled vitamins and hormones for studying intermediary metabolism; S^{35} for the biosynthesis of sulfated mucopolysaccharides of the ground substance of connective tissues. The sodium in the mineral of bone is described both by the transformation of Na^{23} and Na^{24} in undecalcified sections by exposure to a neutron flux and by injections of Na^{22}. The relations of radiation dose to radiation injury with Sr^{90} and the production of bone tumors with P^{32} is dealt with in sufficient detail. The application of radioisotopes to the problems of teeth is also covered in a comprehensive way. Four articles present experimental studies on citrate metabolism, vascular tissue, aging, and ultrastructure of bone.

Pierre LaCroix recognized the need to consolidate the research on the metabolism of radioisotopes in skeletal tissue; thus, thanks to LaCroix and all 47 of the conferees, as well as to the sponsor, the Council for the International Organizations of Medical Sciences, the editors, Franklin C. McLean and Ann M. Budy, were destined to create a very useful volume.

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Engineering Education

Introduction to Chemical Engineering. L. B. Andersen and L. A. Wenzel. McGraw-Hill, New York, 1961. xii + 364 pp. Illus. $9.50.

This volume is one of a series that has been published in an attempt to give undergraduate students of chemical engineering a bird's-eye view of just what chemical engineering is and, at the same time, to give them a grounding in the quantitative principles of the energy-mass balance. The authors also briefly cover a multitude of other physical topics, including phase and chemical equilibria, chemical kinetics, and mathematical methods. A section on digital computer techniques emphasizes the logic of employing flow sheets for a given problem rather than the routine mechanics of computer programming. Some descriptive material which, a decade or two ago, comprised a typical course in industrial chemistry is included under these topics: the chemical process industry; inorganic and organic chemistry; and petroleum and petrochemicals.

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*