attention to the dynamics and function of each element and consideration of disturbances of their metabolism. Strontium, which has received much attention during the past few years, owing to its importance in radioactive fallout, is considered largely in relation to calcium, since the two elements, being closely related chemically, are similarly related in their metabolic behavior.

The authors appearing in this volume, as is true for the work as a whole, have been carefully chosen and are authorities in their respective fields. The editors have produced a work of four volumes that will serve as the standard reference work in all aspects of mineral metabolism for many years. The treatment is dynamic and functional throughout and is designed to serve the interests of research scientists and advanced students in biology, medicine, and agriculture whose interests touch upon the role of minerals in physiology, biochemistry, biophysics, or nutrition. As stated in the subtitle, this is truly an advanced treatise, dealing with every aspect of mineral metabolism, but with emphasis on the mammalian organism, particularly man.

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Practical Chromatographic Techniques. By A. H. GORDON, National Institute for Medical Research, London, and J. E. EASTOE, Department of Dental Science, Royal College of Surgeons of England. D. Van Nostrand Co., Inc., 120 Alexander St., Princeton, N. J. 1964. viii + 200 pp. 14.5 × 22.5 cm. $7.95.

Chromatography has continued to grow at such a pace that each phase of this separation technique warrants its own full volume. Thus, one book which can cover almost all the practical chromatographic techniques is always welcomed, and especially so to the beginner to whom this book is directed.

The book is divided into seven chapters, plus an index, to fill its 200 pages.

The principles of the various chromatographic techniques are discussed rather briefly but quite adequately in Chapter 2. The mechanisms of adsorption, partitition, ion exchange, and molecular sieving are outlined. Column and paper chromatography, their development and the problems of packing, tailing, irregular bands, etc. are included. The old (1941) theories of Martin and Synge of chromatographic behavior based on "theoretical plates" are covered in considerable detail; but the references that follow this chapter are not recent, with only 4 of the 16 from the past 10 years.

The following chapter covers especially well the various column configurations, systems for the addition of solvents, and the preparation of gradients. Surprisingly, several pages are devoted to the details of fraction collectors, all of European design and manufacture. Paper chromatography apparatus is especially well covered and should be most helpful to the beginner. However, only the Whatman papers are mentioned.

Chapter 4 covers adsorption chromatography especially well for the beginner. It gives many excellent suggestions, tells what to expect and what to guard against, and has, in addition, the usual list of adsorbents and eluents. Quite noticeable again is the very limited number of references.

In the chapter on paper chromatography, the beginner might be a bit misled by the statement, "the working time. . .is not much more than five minutes" (p. 91). It might best be mentioned that the time referred to represents only spotting the paper and getting it into and out of the developing tank and certainly does not include the time, which must be counted in hours, spent in solvent preparation, equilibration, running time, etc. As wonderful as paper chromatography may be, it is still a time-consuming operation.

However, it is at this point that one finds the first examples and details of practical paper chromatography. Twelve pages are devoted to amino acid analysis. Solvent systems and R_f values are also given for a number of carbohydrates, purines, and pyrimidines.

The longest chapter is on ion exchange, with the major emphasis again on the practical aspects of the chromatography of amino acids, peptides, and proteins, with the sugars and nucleic acid components getting but very brief coverage.

The final chapter deals with the more recent advances in chromatography. The cellulose and dextran ion exchangers are discussed and their applications, along with a number of good references, are included. The dextran polymer Sephadex, ion-exchange papers, and especially thin layer chromatography are all covered much too briefly. No mention whatever is made of instrumentation which has made many time-consuming chromatographic techniques into rapid, practical methods of analysis and separation.

In summary, "Practical Chromatographic Techniques" will be most helpful to the beginner whose major interest is in the analysis of amino acids and proteins, for it is in this field that the authors excel.

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Les alcaloïdes stéroïdiques des Apocynacées. By ROBERT GOUTAREL, Directeur scientifique AU C.N.R.S., Institute de Chimie des Substances Naturelles DU C.N.R.S., Gif-Sur-Yvette. Hermann, 115 Boulevard Saint-Germain, Paris VI, France. 1964. 289 pp. 17.5 × 24.5 cm. 48 F.

This work is the fifth in a series concerning the chemistry of natural products edited by E. Lederer who has lived up to his promise to have each volume written by an authority in the area to be covered. The title of the monograph, "Les alcaloïdes stéroïdiques des Apocynacées," although correct does not do justice to steroidal alkaloids in general. The bases discussed are those naturally occurring alkaloids with 5-α-pregnane, pregn-5-ene, and conanine skeleta, and there is nowhere in the treatment of either the phytochemistry or the chemistry even an inkling of the true range of structural variation of the steroidal system among alkaloids, since the solanum and veratrum bases were excluded by definition on page 12. Those readers unfamiliar with alkaloid chemistry are simply not told about the relationships, real or theoretical, between the pregnane-derived bases discussed and the excluded groups. It is true that leading references to reviews on solanum and veratrum bases are cited but some of these are hopelessly dated.

The work is divided into four sections, *viz.* the sources, the chemistry, the conversions into steroidal hormones, and the pharmacology of the 5-α-pregnane, pregn-5-ene, and conanine bases with little or no reference to related topics. Each section is clearly and competently presented but suffers because of the limitations mentioned above which the author himself states are self-imposed. The whole emphasis is on the work of the Paris group with those additions from the rest of the world as were necessary to complete the theme. A particular interesting feature of the presentation is the reproduction of the infrared curves (potassium bromide disk) and the mass spectra (*via* sublimation into the mass spectrometer) of all or nearly all of the bases. These graphs along with the other classical data make it a valuable and useful book for which a more comprehensive index should have been provided. To sum up, this is an excellently written almost personal account of Professor Goutarel's contribution to the chemistry of steroidal alkaloids and the reviewer very much enjoyed reading it.

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The Electronic Structure of Molecules. A New Approach. By J. W. LINNETT, F.R.S. John Wiley and Sons, Inc., 605 Third Ave., New York, N. Y. 1964. vii + 167 pp. 14.5 × 22 cm. $4.75.

So much time had gone by since the electron-pair bond concept took shape that one felt sure no new approach at the same usefully unsophisticated level could possibly be forthcoming. Yet, as the title claims, here is a new approach, and in the opinion of this reviewer the claim is justified. This is not to say that the approach is perfect. In fact in another paragraph some criticism will be provided. But the over-riding consideration is that the approach is a fresh one, and one finds himself reading the book with considerable excitement.

Electron pairing is revealed as important often simply as a sort of coincidence. What is physically important is an automatic separation between electrons having the same spin together with separations coming from coulombic repulsions among electrons not having the same spin—all repulsions working against attractions of the sort found in the hydrogen molecule-ion. This theme is helpfully introduced in a few simple chapters in a way which does no great violence to accepted concepts. In the remainder of the book the author goes through examples from inorganic and organic chemis-

try, including a treatment of excited states, and finishing with a Conclusion and Assessment.

One would have liked to see some more mathematics (in an appendix so as not to spoil the simplicity of the book). Thus it seems likely that a proof better than the one on page 19 is possible, so that the last paragraph on page 21 would not have to be apologetic. Then too, some of the superiority of Professor Linnett's approach in the case of the allylic examples may be vitiated when it is realized that the advantageous electronic distributions found are also provided by valence bond structures as ψ^2's (not as ψ's). One is not sure that the author consistently uses ψ^2's for probability densities. Again, not enough attention is given to promotion (yet even if $2s^2$ is left out and bonding in O_2 is described using pure 2p, one seems to retain the advantage of the Linnett method).

The author states that the book "is not, and was never intended to be, the final word." His aims are to make the hypothesis clear and to provide examples, some more definitive, some to indicate where future progress might be made. These aims have been accomplished. The book is certainly to be recommended, and to "old hands" as well as to beginners.

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Azeotropic and Extractive Distillation. By E. J. HOFFMAN. John Wiley and Sons, Inc., 605 Third Ave., New York, N. Y. 1964. xi + 324 pp. 15.5 × 23.5 cm. $14.00.

This book represents Volume 4 of a new series by Interscience Publishers directed toward "Chemical Engineering and Processing." The prior volumes have dealt, respectively, with new separation techniques, mass transfer calculation methods, and liquid–liquid equilibrium. These, as well as the present volume, are in keeping with a recent trend of publishing books dealing with highly specialized topics in chemical engineering, This reflects the increasing specialization of chemical engineers in industry and in universities, as well as the difficulty in producing books of wide scope which are up to date during a period when engineering is undergoing a technological metamorphosis.

Thus, these books are not generally appropriate as undergraduate texts, as training at that level must be based on broad fundamentals rather than on specialized topics. However, several such books can form the basis of a graduate course in allied topics. In such a course their use is often as a reference, while current literature provides the substance of the course material. The practicing engineer might build up a small library of such books as reference sources for advanced techniques in particular specialties. Therefore, this review will be based on an analysis of the book's utility as a reference work for azeotropic and extractive distillation.

The first two chapters are concerned with defining nomenclature, the controlling equations of heat and material balance, and the degrees of freedom available consistent with the number of variables in a particular design situation. Material is presented in a useful and generalized manner and there is extensive graphic illustration of the principles involved. In fact, throughout the book one is struck with the extensive use of graphical presentation and calculation techniques.

Chapter 3 is summary of the necessary thermodynamic relationships to design for a multiphase, multicomponent system. Again the chapter is profusely sprinkled with phase and temperature–composition diagrams to illustrate various types of behavior. The requisite thermodynamic relations are derived from first principles.

The next three chapters consist almost entirely of graphical presentations of typical and atypical binary and ternary distillation systems. The author evidently thinks that by acquainting the reader with a wide variety of systems he can inculcate a qualitative reasoning ability as to alternate processing schemes in various situations. It would be a great assistance if this presentation had been more completely supplemented with textual material and illustrative examples. The reader is somewhat confused by the tremendous array of various types of ternary diagrams.

Chapter 7 is a short chapter in which the use of ternary diagrams for the solution of extractive distillation designs are presented. Discussions in previous chapters have been largely oriented toward azeotropic distillation cases.

The next three chapters represent the most useful ones in the book. Here specific design cases are discussed for multicomponent systems. The illustrative examples given are very helpful. Various techniques are discussed in which alternate assumptions such as constant molar overflow, constant relative volatility, etc., are used to solve the multicomponent design case. These chapters represent a useful reference source for such calculation techniques, largely numerical in nature and do not utilize the graphical methods and presentations of earlier chapters.

Chapter 11 is a summary of literature sources which deal with plate and column efficiencies and the effect of design parameters on these efficiencies. An attempt has been made by the author to be selective in his review of the literature. This material is more effectively presented in other sources, and its inclusion here is justified only in making the treatment complete within this volume.

There is a problem set for respective chapters included at the end of the book. At the end of each chapter appropriate references are given so that the reader may go to more complete treatments of highly specific topics.

One might very well question as to whether a reference work, or text, is required in this specialized field. In principle, an extractive or azeotropic column is just like any other distillation column once the separating agent has beeen added to effect the desired change in relative volatility between components to be separated. Once this new distribution of relative volatilities is known, conventional calculation procedures are appropriate. These methods have been presented in other places. Further, one might question the necessity of having available extensive representations of a variety of distillation paths for ternary sytems. It is true that study of such a folio gives one a better "feel" for column performance that might be expected with various irregular systems. However, is purchase of a book necessary to acquire this qualitative understanding? It is doubtful.

From an over-all viewpoint, the book is a curious collection of topics which, taken together, do not project a clear-cut or complete compilation of existing knowledge in azeotropic and extractive distillation. The omission of the following topics, so important in this area, is to be deplored: (1) discussion of the activity coefficient approach to correlation and prediction of multicomponent, nonideal mixtures; (2) comprehensive presentation of factors affecting choice of extractive and azeotropic agents for particular situations; (3) omission of much of the important current literature in the field, especially that describing important processes in which extractive and azeotropic distillation are involved; (4) lack of a completely worked-out example where a column is designed from first principles, and calculations are continued to the final stage, including enthalpy balances; (5) lack of discussion of importance of computers to this type of design.

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On Physical Adsorption. By SYDNEY ROSS, Professor of Colloid Science, Rensselaer Polytechnic Institute, and JAMES P. OLIVIER, Freeport Kaolin Company. Interscience Publishers, John Wiley and Sons, Inc., 605 Third Ave., New York, N. Y. 10016. 1964. xxv + 401 pp. 16 × 23.5 cm. $15.00.

Although the title does not say so, this book is restricted to adsorption of *gases* on solids, mostly possessing nearly homogeneous surfaces, and furthermore taking place in the region below the monolayer. Ross and Olivier have really produced an expanded research treatise summarizing the work of many years at Rensselaer by Ross and his collaborators to develop workable mathematical techniques to express the interaction of adsorbed molecules with solid surfaces.

The main effort is directed at the development of a unified theory for mobile adsorption on a heterogeneous surface. The expression for the isotherm is based on the Hill–de Boer two-dimensional van der Waals equation. Real surfaces are considered to be composed of small patches (50 is taken as a realistic and manageable number) which have specific and constant interaction energies over each one and independent of the others. Since 1954, Ross has promoted the term "homotattic" for such patches, but with only limited acceptance. For convenience, these adsorption potentials are given a gaussian distribution. To make analysis of data tractable, the last 100 pages are devoted to tables of the fraction of surface covered as a function of the pressure and the two-dimensional van der Waals constants.