Calcd. for $C_{13}H_{15}N_3O_2$: C, 63.66; H, 6.16; N, 17.13. Found: C, 63.90; H, 6.42; N, 17.15). Refluxing XII with 88% formic acid gave *inter alia* a basic material having the m.p. 196–197°, $\lambda_{\max}^{\text{EtOH}}$ 275 mμ, ε 7,000, 293 mμ, ε 6500.[6] On the basis of spectral and degradative data this material has been tentatively assigned the structure XIII, 3-methyl-2-(1,2,5,6-tetrahydro-2-oxo-3-pyridyl)-2H-indazole.[7]

The preparation of these and other synthetic variants of acyltryptamines and related compounds will be described in detail in our forthcoming papers.

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[6] V. Rousseau and H. G. Lindwall, *J. Am. Chem. Soc.*, **72**, 3047 (1950), report $\lambda_{\max}^{H_2O}$ 275 mμ, ε 5800, 293 mμ, ε 5900 for 2-methylindazole. Elemental analyses of XIII for nitrogen done in three independent laboratories fail to agree although carbon and hydrogen values are consistent.

[7] The details of the structure elucidation of XIII and related compounds will be described in future publications.

# BOOK REVIEWS

**The Determination of Stability Constants and Other Equilibrium Constants in Solution.** By FRANCIS J. C. ROSSOTTI and HAZEL ROSSOTTI, Department of Chemistry, University of Edinburgh. McGraw-Hill Book Co., Inc., 330 West 42nd Street, New York 36, N. Y. 1961. xiv + 425 pp. 16 × 23.5 cm. Price, $12.50.

The last two decades have seen an enormous increase in the study of complexes and the measurement of complex stabilities. This volume summarizes the many methods that have been used to determine stability, describes in detail the often intricate calculations, and gives a remarkably thorough bibliography of work in this field. It concerns itself with ionic and molecular association in all their forms. Quite properly, the emphasis is on methods of determination rather than on the compilation of data. The authors believe that experiments to determine stability constants have heretofore often been ill-designed and that the experimental data are not always subjected to a sufficiently rigorous mathematical analysis. They have accordingly devoted considerable space to the many ingenious methods, many of them graphical, for deriving accurate stability constants from the experimental data. Much of the latter material derives from the British and Scandinavian schools of coördination chemistry, with both of which the authors have been closely identified.

In principle, any property which varies with the degree of complex formation can be used to determine the position of equilibrium. The most useful techniques for measuring these properties are outlined. The methods described in detail are potentiometry, polarography and amperometry, solubility, liquid–liquid partition, ion exchange, freezing point, boiling point, vapor pressure, optical and spectroscopic methods, and reaction kinetics. Fifteen of the 18 chapters are devoted to mononuclear complexes formed with only a single type of ligand. The remaining three chapters consider polynuclear systems and mixed complexes.

This new book provides a welcome degree of systematization to the field of coördination chemistry. The reactions considered are always those for the *formation* of the complex species; hence, the terms "instability constant," "dissociation constant," and "ionization constant" are unnecessary and are not used. Nevertheless, in the reviewer's opinion, it is rather artificial to classify weak acids with metal complexes. A great majority of common solvents are protogenic or protophilic in some degree; hence, the dissociation of acetic acid, for example, is generically quite a different process from that by which the ammine complex of copper is broken into its constituent parts. The suggestion that the electron may be regarded as a ligand in oxidation–reduction equilibria will be regarded by many as an instance of carrying systematization a step too far.

For practical reasons, many, if not most, stability constants are neither activity quotients nor thermodynamic constants, but rather are concentration constants determined in a constant ionic medium, usually of high ionic strength. The various types of stability constants and the basic principles upon which their determination is based are very capably described. It is further evident that the authors are aware of the limitations of the "constant medium" procedure and of the unfortunate fact that stabilities determined in different constant ionic media cannot strictly be compared.

Nevertheless, it should not be implied (as on p. 29) that "in the presence of high concentrations of background salt . . . the activity coefficient of the solute may . . . be assumed to approach that of the bulk electrolyte," in other words, that through its mere preponderance, electrolyte B is able to impose its properties on electrolyte A. This is demonstrably untrue. In a mixture of 0.01 *M* hydrochloric acid and 2.99 *M* sodium chloride, the activity coefficient of sodium chloride is 0.714. According to this postulate, the activity coefficient of the hydrochloric acid should also be 0.714 in the mixture, but experiment shows it to be 1.062. Although the activity coefficients of different cations (whatever they may be) can possibly be rendered constant by this means, it seems certain that they cannot be made equal. Furthermore, a "swamping electrolyte" without a common ion (*e.g.*, sodium perchlorate) can likely do no better.

The large number of symbols employed (105, drawing heavily on the English, Greek and German alphabets, are listed and defined in the front of the book) assures the rigor of the treatment but detracts somewhat from the readability. The book is exceedingly well written, carefully edited, and attractively printed. The discussion is thorough and authoritative; very few errors of fact were noted and none of typography. This volume should be a part of the library of anyone concerned with the determination of stability constants.

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ROGER G. BATES

**Probability and Experimental Errors in Science. An Elementary Survey.** By LYMAN G. PARRATT, Professor of Physics, Chairman of the Department of Physics, Cornell University, Ithaca, New York. John Wiley and Sons, Inc., 440 Park Avenue South, New York 16, N. Y. 1961. xv + 255 pp. 15.5 × 23.5 cm. Price, $7.25.

Nearly thirty-five years have passed since Sir Ronald A. Fisher wrote "Statistical Methods for Research Workers" to show experimenters how their traditional but inadequate machinery for summarizing measured data can be replaced with a rigorous statistical methodology based on logical relationships between small-sample statistics and population parameters.

Sir Ronald developed this methodology in collaboration with research workers in the biological sciences, and it has been adopted in many fields of applied science and technology since that time. Research workers in the physical sciences have been slow to replace the traditional treatment with small-sample statistical methods; and very few academic scientists appear to be seriously trying to teach their students how to use these methods.

Professor Parratt's book was written, "to introduce the undergraduate student to the unifying concepts of probability and statistics as they apply to science" (pp. vii, viii). He devotes chapter one to a historical survey of ideas about probability and to an explanation of classical (*a priori*) and experimental (*a posteriori*) probability. In the first part of chapter two, he points out the close relationship between scientific reasoning and the correct interpretation of measurements, and gives some basic definitions of errors, significant figures and the rounding of numbers. The rest of the chapter deals with frequency distributions, location indices and precision indices.

The statistics of measurements, in functional relationships, is presented in chapter three. Equations that govern the propagation of errors are given for sums and differences as well as for products and quotients. Use of the t-test and the F-test to examine the consistency of means and standard deviations is explained. The method of least squares for fitting curves to experimental data is developed. The chapter closes with a short discussion of the design of experiments.

In chapter four, the normal probability distribution is derived by way of the binomial distribution; and its mathematical properties are discussed in great detail. The $\chi^2$ for goodness of fit is explained.

The final chapter is devoted to the Poisson probability distribution; and its application to measurements of radioactive decay is explained in detail.

Many problems are given at the end of every chapter and a glossary summarizes the equations developed throughout the entire book.

This book does not appear, to this reviewer, to be worth the price to the chemist, student or professional. Too much time is devoted to mathematical probability and statistics; and too little time is used to explain the logic of experimental design which experimenters learn, with difficulty, by themselves.

The most disturbing thing about the book, to this reviewer, is the way the author has jumbled inadequate traditional machinery with the more useful small-sample methodology. The equation for the normal probability distribution is derived with parameters $h$ and $z$ rather than $\sigma$ and $\mu$. The mean deviation is defended because it is simple to compute and puts less weight on the larger deviations. Probable errors are used extensively throughout the book and the author justifies this because "most experimenters have a sort of intuitive judgment about the reliability of measurements as a consequence of their laboratory training" and because "the experimenter believes that systematic errors are never quite eliminated, a situation that requires some guessing anyway" (see p. 148).

The most inadequate machinery in the book is Chauvenet's criterion for rejecting "bad data." This procedure, first suggested by an astronomer in 1891, has been cited and recited in books on least squares and the theory of measurements. The rejection of data should not be justified on statistical arguments.

The author sometimes presents misleading, if not erroneous, explanations of statistical methodology. The F-test comparing variances is set up on pp. 124–126 with the larger variance always in the numerator (two-tail test); but the 5% limits of F in Table 3–2 are for a one-tail test and would really be 10% for the situation described.

Again, in section 3–7, the concepts of correlation and regression are badly mixed up and Figures 3–4 shows a scatter diagram of physics and mathematics grades with "probable-error lines parallel to a regression line, rather than the appropriate 50% ellipse about the mean values of the two sets of grades."

The book also fails to present some of the most useful statistical techniques available to the experimenter. No mention is made of control charts anywhere in the book; and the procedure of putting confidence limits about the small-sample estimates of a mean, standard deviation, or regression coefficient, and the interpretation of such confidence intervals is never discussed.

Although the author shows how to use the F-distribution to test for the consistency of variances, he makes no mention of the fact that this distribution is much more powerful when used to make significance tests of results from properly designed factorial experiments.

This reviewer feels that authors of books on probability and statistics for scientists should not devote much time to the mathematical machinery of probability and statistics because there are already many books which do this exceedingly well. What the scientist needs is help in framing his problems and designing his experiments so that the machinery will be able to help him interpret the results.

KODAK PARK WORKS
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ROCHESTER 4, NEW YORK
GRANT WERNIMONT

**Principles and Applications of Paper Electrophoresis.** By CH WUNDERLY. Member of Scientific Staff, Medical University Clinic, Zurich (Switzerland). D. Van Nostrand Co., Inc., 120 Alexander Street, Princeton, New Jersey. 1961. xii + 253 pp. 13 × 19 cm. Price, $5.00.

Since the publication on the quantitative analysis of proteins by Consden, Gordon and Martin (*Biochem. J.*, **38**, 224 (1944)), paper chromatography has become a powerful tool for the study of components in biological systems. It is interesting to note, however, that the development and use of paper electrophoresis dates from the isolation of a yellow protein from snake venom by König and Klobusitsky (*Naunyn-Schmiedebergs Arch. exptl. Pathol. Pharmakol.*, **192**, 271 (1939)) which took place five years earlier.

This small book is a lucid and concise review of judiciously selected methods and techniques in paper electrophoresis. As might be expected, the predominant amount of space is devoted to proteins and their derivatives, but an excellent theoretical discussion and description of methods extends its usefulness to a much broader group of investigators. An extensive bibliography completes the necessarily scant details in a volume of this size.

Publications in rapidly developing areas suffer from unavoidable delays between preparation and publication. This book is a completely revised edition in English of a well-received three-year old German text by the same author. Thus, one would have hoped to find in a work of this high quality, a more complete discussion of recently developed low temperature techniques. This limitation aside, the book is a valuable addition to the growing series of Elsevier Monographs.

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**Nouveau Traité de Chimie Minérale. Tome XIII. Premier Fascicule. Oxygène, Ozone, Oxydes, Eau oxygénée, La Combustion, Soufre(I).** Edited by PAUL PASCAL, Membre de l'Institut, Professeur honoraire à la Sorbonne. Masson et Cie, 120 Boulevard Saint-Germain, Paris 6, France. 1960. xxxix + 1124 pp. 17.5 × 26 cm. Price, broché 310 NF.; cartonné toile. 330 NF (two parts).

This is the first part of Volume XIII which deals with elements of Group VI, namely O, S, Se, Te and Po. As in most of the other volumes of this monumental treatise published so far the introductory chapter (60 pages) is written by the editor himself. It makes for interesting reading from the historical and systematic viewpoints, and the bibliography (some 300 entries) gives an idea of its scope on both counts. Very few misprints and only one or two erroneous statements were found in this chapter. (On p. 5, the explanation for the different valence angles in the series of compounds $F_2O$, $Cl_2O$, etc., is not consistent with the accepted views; on p. 53, the configuration of the $H_2S_2$ molecule is known to be neither *cis* nor *trans*).

The chapter on elementary oxygen by A. Pacault covers the subject adequately in some 180 pages with 300 references. There follows a 70-page chapter on ozone by Josien and Sourisseau, which may have been completed somewhat before the others in this volume since the bibliography ends earlier (1954 instead of 1958–1959). Thus the latest work on the thermal decomposition of gaseous ozone was missed.

At this point a very useful and well organized section of some 150 pages on the crystal structure of oxides and related