

reached a wider circle of readers under the title "Spot Tests" (first edition, 1937). Though published separately much later, there must have been many who deplored the omission from this English text of the 128-page "Theoretischer Teil" of the original work, which discussed in such a masterly and stimulating way the factors governing specificity, selectivity and sensitivity, and the relationships between colour, solubility, fluorescence, etc., and the constitution of the substances under investigation. The present volume may be said to have been developed from this section of the original work, and it has clearly been written with three groups of readers in mind: the first includes those who wish to understand the chemistry and physical chemistry underlying contemporary analytical procedures; the second those who are actively engaged in research and developing new methods in analytical chemistry and related fields; and the third group includes those interested in chemistry primarily from the experimental angle.

On the annexation of Austria by the Nazis, Prof. Feigl lost his chair at the University of Vienna, and in the subsequent flight from Europe in 1941 he lost the whole of his laboriously gathered material. The present volume is thus more than a work of ripe scholarship, for it reflects the pertinacity, the industry and the great courage of its distinguished author. Still more perhaps it breathes enthusiasm for the subject in every page. After describing the role of reaction conditions in defining the sensitivity, selectivity or specificity of a chemical test, a lengthy chapter deals with complex and co-ordination compounds and the part they play in analytical chemistry. Here, as elsewhere throughout the book, false distinctions between principal and subsidiary valencies are still drawn, nitrogen appears as pentavalent, sterically impossible formulæ are uncritically proposed and the general treatment of valency theory is seriously outmoded. The urge to devise structural formulæ for substances (for example, $\text{CHI}_3 \cdot 24\text{S}$) which are almost certainly lattice-compounds, and to infer from the empirical formula of a solid phase the nature and stability of ions present in solution with it, is regrettably shared by many of the authors of the text-books to which Prof. Feigl refers.

A most suggestive chapter on masking and de-masking of reactions is followed by a discussion of catalysed and induced reactions and the effect of complex formation on increasing reactivity in certain cases. Nearly two hundred pages are then devoted to a very comprehensive review of the effect of atomic groupings in controlling the specificity of organic reagents for use in inorganic analysis; a shorter section deals similarly with reagents for organic analysis. Regularities and anomalies in the solution of materials in indifferent solvents occupy thirty pages, and not surprisingly this raises more points than it solves, as indeed does the next chapter dealing with the effects of size, shape, substitution and constitution on the solubility and salt-forming capacity of organic reagents.

Prof. Feigl is an outstanding 'picker-up of unconsidered trifles' and has a genius for adapting the most obscure and *recherché* observation to an elegant and specific analytical procedure. This is admirably illustrated in the long and very informative chapter dealing with surface effects in analytical chemistry, still more so perhaps in Chapter 11 dealing with the genetical formation of materials and the quite fascinating subject of topochemical reactions. The

concluding chapter, on the use of fluorescence effects and photochemical reactions, is included for the sake of completeness, though the subjects are dealt with better and at greater length elsewhere.

One is seldom aware that this is a translation, and for this we must congratulate Prof. Ralph Oesper. There are, of course, many errors of fact in this book, and the reader may disagree—even violently—with many of the theoretical interpretations which the author puts forward; but he cannot fail to be stimulated. Prof. Feigl has shown himself to be a great artist in the field of analytical chemistry; and the fact that he brings his great reputation and authority to demonstrating that it is no mere technology but a sadly neglected science is a matter for which we must all be grateful. This unique and pioneering book must certainly find its way into the hands of every serious analytical chemist; but it should be diligently perused no less by every organic, inorganic and physical chemist, who may thereby become aware of the many and great problems which await the exercise of his particular talents and outlook.

H. IRVING

MICROGRAM ANALYSIS

Quantitative Ultramicroanalysis

By Prof. Paul L. Kirk. Pp. vii+310. (New York: John Wiley and Sons, Inc.; London: Chapman and Hall, Ltd., 1950.) 40s. net.

SOME ten or fifteen years ago, text-books on microchemical analysis came forward frequently for review, and it was a normal gambit to note that these dealt with new techniques. Some indication of the rapid expansion of this branch of chemistry may be gained from the realization that this is the first text-book devoted entirely to techniques which stand in much the same relation to normal microchemical techniques as these latter do to the classical analytical procedures.

Prof. P. L. Kirk is well qualified to present an account of these latest small-scale methods, since he was closely associated with the development of many of them, both in his earlier biochemical work, and then in his post with the Manhattan Project, where he was in charge of chemical control methods. As most chemists are now aware, the development of adequate microgram procedures was of vital importance in atomic energy work.

In this book the methods described are almost exclusively volumetric, gasometric or colorimetric, and are largely confined to the biochemical field. Gravimetric methods receive little attention, and there is little discussion of instrumental methods other than absorptiometric.

In spite of this severe restriction, the book offers a welcome foundation for work in the microgram range. Analytical chemists and biochemists find an increasing need for these techniques. They have here a valuable introduction to basic apparatus and methods which, more particularly in the volumetric field, is authoritative, full, clear and timely. It seems likely, also, that a considerable proportion of the rather specialized biochemical apparatus and methods may readily be adapted to more general application. Finally, the contents of the book will undoubtedly stimulate many workers to develop to the full these fascinating methods of analysis which are at present only in their infancy.