to ferromagnetic substances. But the result is a volume of the highest value (and nearly the highest price).

The volume opens with general remarks and general references, symbols, units, theories of ferromagnetism and related topics, and then launches into a wealth of carefully organized information on metals, alloys, oxides and other ferromagnetic substances. Electrical properties are included, especially as these may be related to magnetization. Convenience of use is increased by marginal headings in English. A very few ferromagnetic substances appear to have escaped attention. Of these, metallic gadolinium seems to have been intentionally omitted (the rare earth "garnets" are adequately treated) and silver difluoride has been overlooked. The volume concludes with over 100 pages of patent references, formula index and trade names.

While the exhaustive literature survey terminates at the end of 1955, there are more than a few references through 1957.

The volume is recommended without reservation to anyone interested in ferromagnetism or in solid state inorganic chemistry. It should be required reading for those still unaware of the modern position of inorganic chemistry.

DEPARTMENT OF CHEMISTRY
NORTHWESTERN UNIVERSITY
EVANSTON, ILLINOIS
P. W. SELWOOD

Ultracentrifugation in Biochemistry. By HOWARD K. SCHACHMAN, Biochemistry and Virus Laboratory, University of California, Berkeley, California. Academic Press Inc., 111 Fifth Avenue, New York 3, N. Y. 1959. xii + 272 pp. 15.5 × 23.5 cm. Price, $8.80.

It appears that it was the original intent of the author to provide a review on sedimentation analysis for the *Advances in Protein Chemistry*, perhaps a companion article to the earlier Gosting article, "Measurement and Interpretation of Diffusion Coefficients of Proteins," which had appeared in the *Advances* in 1956. However, it came to be felt that recent developments in the theory and practice of sedimentation analysis had been sufficiently extensive in recent years to require space beyond the bounds of the conventional review for adequate description. The result is an impressive independent monograph, one we have read from start to finish with undiminished interest. Above all, it teaches that sedimentation analysis is a subject of many ramifications.

Except for a short, largely historical introduction, the monograph proper is written in six sections. In the first of these longer sections, of title "General Considerations," ultracentrifugation is divided into three areas: sedimentation velocity, sedimentation equilibrium and the approach to sedimentation equilibrium or the transient states. In addition the Lamm differential equation of the ultracentrifuge is derived. Following a section called "Experimental Aspects," the fundamental principles of each of these three major divisions of the subject are considered in separate sections. The final section, "Interpretation of Sedimentation Data," describes additional items which have to do with the transport experiment. The discussions which form the sections "Experimental Aspects" and "Sedimentation Velocity" require some sixty per cent. of the text pages. The main sections are followed in the make-up of the volume by extremely useful listings: some twenty-four pages of "References," "Glossary of Terms," "Author Index" and "Subject Index" items.

So, in large part, the monograph deals with the principles and practice of velocity sedimentation as they are now being applied in the solution of biological and medical problems. Nowhere is the author more at home than when he is describing a wide variety of experimental techniques. Considerations of the correct procedures for the evaluation and interpretation of sedimentation coefficients are uniformly well handled, and relationships between the measured coefficient from a given type of experiment and the concentration to which this datum corresponds are established. The correlation of sedimentation and diffusion measurements to produce equations for solute molecular weight is treated much in the fashion of the classical approach to the traditional two-component, incompressible system.

The classification of the methods to obtain the familiar Svedberg equation, Section VII, 1, seems to be not entirely clear. There is the classical kinetic theory or microscopic analysis in its various forms, a force–friction concept which is applicable only to the two-component, incompressible system. However, we would describe the more recent derivations, those which contain in them the implementation for extension to multicomponent systems, as being momentarily two in number, but perhaps eventually only one in kind. They are: (a) the "quasi-thermodynamic" or "dynamical" derivation in which the force–friction concept is retained (Lamm, 1953, 1959).

(b) The use of the negative gradient of the total potential as the driving force in sedimentation to adapt the general theoretical and practical flow equations of the thermodynamics of irreversible processes to the sedimentation velocity experiment (Hooyman, *et al.*, 1953, 1956; *cf.* also Williams, *et al.*, 1954, 1958).

One of the neglected subjects in sedimentation analysis is that of charge effects. The early fundamental and rather extensive treatments of Svedberg, Tiselius, Lamm and Pedersen (to which references are given) have stood the test of time, but their teachings have been sometimes forgotten; we had hoped now to find that they had received a somewhat more definitive and up-to-date interpretation and review. Because of these charge effects it is necessary to study proteins and other macro-ions in systems of three components, the additional solvent component being "supporting electrolyte" in an amount which is "sufficient" to repress these charge effects. In its presence another concentration gradient is produced in the ultracentrifuge cell, either at equilibrium or in transport. Now, as we have intimated, the simpler equations become inadequate, and although much theoretical work remains to be carried out, the pathways have been marked by which the relationships can be improved. In the meantime, the practical biochemist must be continually alerted to this situation.

Even with systems which contain only neutral molecules, the use of mixed solvents in an experiment has been the cause of much misinterpretation. In general, as soon as one comes to study "Multicomponent Systems," Section VII, 5, our complications enter in the description of a process which is basically simple, and one cannot carry over directly these less sophisticated approaches in the theoretical analyses. Thus, the derivation of equation (136) should be re-examined. What Peller has suggested, *cf.* footnote to pages 235–236, is that the evaluation of "binding" data from sedimentation velocity experiments in ternary systems without reference to diffusion measurements may be tenuous. The terms to include these diffusion measurements, or additional friction coefficient terms, do not appear in the equation (136) and in others based upon it. Lastly, in connection with this sub-section, we note with regret that the definition of particle volume, *v*, divided by mass, *m*, is retained for the partial specific volume.

However, we must look in another direction. In the monograph, the mathematical apparatus has been kept at an intermediate level because the individual interested in ultracentrifugation is likely to be a biochemist, and it is really to him that the book is addressed. With the excellent description of newer experimental techniques, the clear statements of basic ideas and principles and the extensive bibliography and indices, such a worker cannot afford not to have this book as companion and friend.

DEPARTMENT OF CHEMISTRY
UNIVERSITY OF WISCONSIN
MADISON 6, WISCONSIN
J. W. WILLIAMS