JOURNAL OF APPLIED ELECTROCHEMISTRY 20 (1990) 341–342

NEWS

Book reviews

The Nature of Electrolyte Solutions
M. R. Wright,
Dimensions in Science Series, Macmillan,
Basingstoke (1988)
ISBN 0 333 447 2, 145 Pages, £5.95

As I read this book, starting at the beginning, my main reaction was development of progressive irritability. Having taught aspects of pure and applied chemistry for forty two years I know that one of the most difficult objectives to achieve is to make students unlearn something already taught and replace it with upgraded information. As I read the text, I periodically noted statements which were not true because they were not qualified; the qualifications appeared later. This approach to dealing with a topic as complicated as electrolyte solutions is the result of the objective of this series, which is to show how scientific knowledge is generated and techniques are developed and applied, starting with common core A-level knowledge.

The subject matter used is mainly conventional. The way in which it is used is almost completely non-mathematical. The modern theory of ionic solutions has been developed on the basis that the law of the forces of attraction and repulsion between ions in solution is known. This law is expressed by the Debye-Hückle theory, which holds accurately for extremely dilute solutions of strong electrolytes. Pseudo-theoretically based equations, to extend the Debye-Hückel equations, to represent measured behaviour of strong electrolytes to higher concentrations were developed but are no longer used.

The following is an excerpt from page 60: "... makes us appreciate just how naive the Debye-Hückel primitive model is. But when we look at the complexities of fitting this very simple model into a mathematical framework, and the even greater complexities of solving the mathematics, we can understand how badly stuck we are with a model which is so physically unrealistic". An undergraduate studying chemistry would be expected to interpret this as indicating that the Debye-Hückel equation is of no value and lectures on the theory are a pedantic exercise. A student with special interest in biological sciences, towards whom this book appears to be particularly directed, would almost certainly do so.

However, the correlations between activities and concentrations of substances in solution are of great and fundamental importance in many scientific and technical processes and applications. Therefore, it would have been appropriate in this book to indicate how scientific knowledge concerning aqueous solutions of mixed electrolytes, which are innumerable and in many cases of great practical importance, has been generated. This is achieved by taking experimental values of activity or osmotic coefficients of aqueous solutions of single electrolytes, of which there is a limited number of importance and for which such data already exists, and combining those data by means of derived coefficients. The best known and most used technique of doing this at present is use of the Pitzer coefficients.

It is a pity that some modern texts dealing with inorganic or physical chemistry tend to suggest that the subjects are concerned with matters of great intellectual importance which are never applied to any useful purpose. This book is one of them. However, it is suitable for undergraduate courses requiring knowledge about electrolyte solutions. Solvation is dealt with in Chapter 4, leading on to biological systems and to Chapter 5 on charge-separated ions, taking the reader further in that direction. A good feature of the book is the discussion of experimental evidence concerning the structure of the solvent in aqueous solutions of electrolytes, based on X-ray and neutron diffraction and on NMR. The mention of computer simulations in attempting to extend the range of application of the Debye-Hückel equation is likely to appeal to some students, as are the style of presentation of the text and the price.

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Electroanalytical Techniques in Clinical Chemistry & Laboratory Medicine
Joseph Wang

This short book has been described by the publishers as a "practical introduction to all the electroanalytical techniques that are used in Clinical Chemistry and Laboratory Medicine and is the only in-depth treatment of the subject available". Whilst other authors may take issue with this wide sweeping claim, especially the use of "all", "only" and "in-depth", it is true that the book is a good introduction to the range of electroanalytical techniques which are currently applied in laboratory medicine. This particular reviewer would hesitate to apply the term "in-depth" to some of the topics covered, especially those where the book's author is apparently inexperienced. The book consists of five chapters, the relative lengths of which indicate the author's own confidence in describing particular techniques or where he is familiar with the subject matter.

The first chapter (45 pages) covers a general introduction to voltametry and other controlled-potential techniques – topics familiar to all electrochemists, but useful material for the biological/clinical scientist entering the field of biosensors.

Chapter two (27 pages) describes a range of ion-selective electrodes for the measurement of pH and body electrolytes. Curiously, a brief description of the oxygen electrode and the amperometric technique, is included here and is totally out of place. Furthermore, it is given only a very cursory description. Perhaps the author could not think of anywhere else in the book to insert anything on amperometry! It is also a pity that the author gives unhelpful statements here about the blood sample temperature and flow artifacts (physiology), linking them with the current-temperature (electrochemical) dependence of the sensor. Separate issues are involed here and the author merely confuses the reader at this point.

Chapter three (27 pages) is intended as an introduction to electrochemical biosensors and briefly describes enzyme electrodes, as well as giving clinical examples of their use. Immunosensors are mentioned, although this particular section is very skimpy indeed.

Chapter four (34 pages) is probably more familiar territory to the author, and covers electrochemical detection techniques for liquid chromatography and also describes automated flow systems for use in a clinical laboratory. This chapter, in particular, is copiously referenced and would be of interest to both the chemist and the clinical scientist.

Chapter five (20 pages), the final chapter, is an attempt to describe the mine-field area of *in-vivo* electrochemistry, an area where many a chemist and clinical scientists has come to grief. It is impossible, in 20 pages, to deal with this topic "in-depth", and the author could have worked harder on this important chapter and greatly increased its length. The author appears to be unaware that *in-vivo* oxygen probes are marketed commercially for continuous PO_2 measurements in neonates and in adult intensive care situations, and he fails to describe these devices in detail. This omission is all the more questionable because he then gives more coverage to experimental probes for measuring body electrolytes, the use of which are still confined to the design laboratory or animal laboratory. Lastly, but not least, the author dismisses the design of non-invasive transcutaneous O_2 and CO_2 sensors in a few words – whereas they now form a significant proportion of the clinical biosensor health care market.

One very useful aspect of this book is that each chapter ends with a fairly comprehensive reference list, most of which originate in the early 80's. There are some references for 1986, and this reviewer found one for 1987. They do, however, form a useful base for the book reader to refer to.

Despite the above criticisms and reservations, this book will be helpful to both the analytical chemist, as a basic introduction to biomedical sensors, and to the biological/clinical scientist commencing work in the electrochemical analytical field. Accordingly, this book will be a useful addition to the departmental library.

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