NMR IN LIVING SYSTEMS.

T. Axenrod, G. Ceccarelli, Eds. Dordrecht, The Netherlands, D. Reidel Publishers, 1986, $54.00, 410 pp

This book is based on the lectures delivered at the NATO Advanced Institute held in Altavilla Milicia (Sicily), Italy in September 1984. It has 25 chapters. The basic concepts of nuclear magnetic resonance (NMR) are covered in the first few chapters. More advanced topics dealing with imaging, in vivo spectroscopy, and determinations of cation concentrations in living systems are covered in the subsequent chapters. Also, it includes some interesting nonmedical NMR applications and other imaging modalities.

It is very difficult to provide an in-depth coverage for a very diverse and interdisciplinary field like NMR in living systems. It is the feeling of this reviewer, however, that some of the topics did not receive the in-depth coverage they deserve. For instance, one of the most important topics like basic theory of NMR imaging and comparison of different imaging techniques should have been covered in greater detail. Some of the chapters are less than ten pages long. Not accidentally, some of the best written chapters are among the longest.

As was pointed out in the preface, the last ten years have witnessed a tremendous progress in the imaging and spectroscopic application of NMR to the living systems and there is clearly a need for a book of this type. Because of rapid developments in this field, understandably this book did not include the latest developments like image based localization methods, fast imaging techniques and imaging of nuclei other than protons.

The book was printed on a good quality paper and the figures are reasonably clear. There are, however, a large number of typographical errors and some of the figures are mislabeled. At least one figure is missing (Chapter 10).

In summary, this book does a reasonable job of covering a large number of topics dealing with NMR in living systems and has a place in all the NMR research laboratories. Though it does not provide an in-depth coverage, it does make the intelligent novices aware of the various potentials of NMR as applied to living systems. It is therefore suitable for anyone contemplating entering this field.

PONNADA NARAYANA
The University of Texas Health Science Center
Houston, Texas

ANALYTICAL AND CHROMATOGRAPHIC TECHNIQUES IN RADIOPHARMACEUTICAL CHEMISTRY.

D. M. Wieland, M. C. Tobes, T. J. Mangner, Eds. New York, Springer-Verlag, 1986, 300 pp, $49.50

Radiopharmaceutical control and development requires the characterization of radiochemical entities which is ultimately dependent on the choice of suitable chromatographic methods. This book is a complete treatise of chromatography written for the radiopharmaceutical scientist. The text contains updated and expanded versions of presentations from a June, 1984, symposium sponsored by the Radiopharmaceutical Sciences Council of The Society of Nuclear Medicine. The editors and authors are prominent American radiopharmaceutical scientists.

This is a hard-back book with a type-set text. Understanding is facilitated by clearly illustrated figures and appropriate tables. All contributions are thoroughly referenced and the text is well indexed. The editors have achieved a high degree of continuity that is seldom found in a symposium proceedings. There is a consistent format for each paper.

This book is divided into three parts. The first section contains four chapters which address all aspects of thin layer chromatography (TLC). Topics include high performance TLC evaluated by scanning densitometry, a review of radioanalytical techniques using TLC and electrophoresis for common radiopharmaceuticals, performance and design of radio-TLC imaging systems, and the application of position-sensitive wire chambers to these methods.

The second section contains a description of high pressure liquid chromatography (HPLC) techniques and instrumentation. The initial chapter presents a lucid review of HPLC theory and components of radio-HPLC systems. Other topics include approaches to quantitation of HPLC samples and design of flow-detector systems.

The final section contains six chapters describing applications of chromatographic techniques to organic molecules and metal chelates (particularly technetium-99m drugs), metabolic tracer studies, ultra-short lived radiotracers, and radiolabeled antibodies. This section is particularly valuable because the authors lead us through the decision-making process in selection and application of methods to representative compounds.

The educational level of this book is advanced and it is more appropriate as a library resource in the teaching institution. It is an exceedingly useful reference for anyone with a serious interest in radiochromatographic techniques. It will be the authoritative text for this subject matter in the near future.

JAMES F. COOPER
Medical University of South Carolina
Charleston, South Carolina

POSITRON EMISSION TOMOGRAPHY AND AUTORADIOGRAPHY—PRINCIPLES AND APPLICATIONS FOR THE BRAIN AND HEART.

M. E. Phelps, J. C. Mazziotta, H. R. Schelbert, Eds. New York, Raven Press, 1986, 690 pp, $89.50

This book is a research compendium for positron emission tomography (PET) and autoradiography covering the current and not-so-current aspects of quantitation, modeling, and

radiopharmaceutical chemistry, and their application to the brain and heart. It is introduced in proper fashion with a chapter by a father of the field, Louis Sokoloff, describing the quantitative autoradiographic basis for the measurements of cerebral circulation and metabolism. PET research is based to a large degree on these autoradiographic studies and techniques.

Chapters on in vitro and in vivo receptor binding autoradiography and the basic principles and instrumentation of quantitative autoradiography give more than enough information and provide a background for the chapters on PET that follow. Sections on PET instrumentation and quantitation, tracer kinetic modeling and parameter estimation, and positron radiopharmaceutical production and chemistry lead into the two final chapters. In this final section, the physiological and biochemical measurements, for which PET and its array of radiochemicals are heralded, are applied to the brain and heart. For the brain, both normal physiological stimulation and its many neuropathological disorders are treated from the perspective of the metabolic rate of glucose and oxygen, blood flow, and blood volume. The heart chapter is focused on the heart as an organ that can utilize different metabolic substrates, and the coverage of pathology is based on myocardial ischemia and cardiomyopathy. Equal emphasis is given to the brain and the heart. For both organs the basics and the basic science of circulation and metabolism progress toward the application of the PET technique to the quantitative measurement of metabolic rate and circulation in health and disease. A glossary is included to round out this book. The literature is well cited. The organization, choice and depth of topics leave the reader with the impression that this book has been well edited.

This book tells one story and leaves one nagging question. PET is complex; basic science must be dealt with at every level of a PET study. Quantitative PET requires careful attention to many potential pitfalls even with equipment that is commercially available. Where is the PET payoff? PET has not reached its potential of providing definitive and easily administered diagnostic tests. Hints of the payoff are given in the last two chapters and depend on the background of basic knowledge that is presented in the rest of the book. Although beyond the scope of this monograph, the answer to this question appears to be that PET will stimulate the development of technetium radiopharmaceuticals that, with SPECT, will fulfil that potential.

This book is quite obviously from the UCLA school of positron study that goes back to the earliest days of PET. The contributions of this productive group of investigators are highlighted.

The field of PET has matured to the point where a good monograph, or several, should be available. This is one of them. PET has grown and as a result, there are now many centers able to perform PET studies, with others planned or under construction. This book, and perhaps one or two more, would be a must for someone setting up a PET center or reviewing the field from an established laboratory. The specific chapters cover their fields with enough current awareness so that the specialist would be kept interested.

STEPHEN C. JONES
Cleveland Clinic Foundation
Cleveland, Ohio

THE VISUAL DISPLAY OF QUANTITATIVE INFORMATION.

E. R. Tufte. Cheshire, Connecticut, Graphics Press, 1983, 197 pp., $34.00, cloth

THE ELEMENTS OF GRAPHING DATA.

W. S. Cleveland. Monterey, California, Wadsworth Advanced Books and Software, 1985, 321 pp, $27.95, cloth; $18.95, paper

The successful communication of numerical data is often in a graphical rather than a tabular form. Creating good graphs is difficult, even for workers in a visually oriented field such as nuclear medicine. These two books present bad examples and their improvements and also guidelines for good graphics.

After flipping through both books, Tufte's *The Visual Display of Quantitative Information* is the more attractive for a thorough reading. The layout is inviting and the figures are fascinating. An 1869 chart by C. J. Minard depicting Napoleon's Russian campaign of 1812 is often used in advertisements for the book. Tufte discusses graphical practice with chapters titled "Graphical Excellence," "Graphical Integrity," and "Sources of Graphical Integrity and Sophistication." Graphical excellence is defined as "that which gives to the viewer the greatest number of ideas in the shortest time with the least ink in the smallest space." Tufte then decries the quality of graphic presentations in most U. S. popular media and suggests that a contempt for the reader's intelligence and a lack of quantitative skills on the part of those producing the graphics necessarily leads to poor graphics. "Graphical competence demands three quite different skills: the substantive, statistical, and artistic." The second part of the book presents a theory of data graphics with chapter titles, "Data-Ink and Graphical Redesign," "Chartjunk: Vibrations, Grids, and Ducks," "Data-Ink Maximization and Graphical Design," "Multifunctioning Graphical Elements," "Data Density and Small Multiples," and "Aesthetics and Technique in Data Graphical Design." Tufte argues that the ink in a graph should convey information and that extraneous borders, grids, crosshatching, labels, and decoration should be removed.

Cleveland's *The Elements of Graphing Data* is less eye-catching than Tufte's book, but Cleveland is concerned more narrowly with scientific and technical data. He divides the book into four chapters: an Introduction, "Principles of Graph Construction," "Graphical Methods," and "Graphical Perception." The conclusion of the second chapter is a list of principles covering clarity both of the graph's appearance and the information it conveys, the scaling of the data, and the strategy of graphing data. These two pages would serve well posted above many drafting tables. Cleveland then proceeds to a thorough presentation of methods to implement these principles. Among his more interesting techniques are the use of two-tiered error bars to reflect more realistic confidence intervals for data points and the scatterplot matrix as a means for presenting three and higher dimensions of data on a flat page. The last chapter discusses a number of psychophysical theories and experiments which bear on the perception of graphical techniques. Many approaches, such as representing quantities by areas of objects, prove to be difficult to perceive accurately. The most reliable presentation uses position along a scale.

Cleveland's book is the better book for students and medical illustrators. Its only shortcoming is that a figure and the text