Two good texts for clinical applications of nmr

NMR Imaging in Biomedicine
P. Mansfield, P. Morris
354 pages, Academic, New York, 1982. $49.50

Nuclear Magnetic Resonance and Its Applications to Living Systems.
E. Gadian
Oxford U.P., New York, 1982. $29.95

Reviewed by R. Mark Henkelman

It is always an exciting phase in the development of science when an academic and basic field of study blossoms into a greatly expanded area of application. This prolific development, now occurring with the use of nuclear magnetic resonance in medicine, stems from two new capabilities: to make images using nuclear magnetic resonance and to measure nmr spectra in living subjects.

Physicists first proposed nmr imaging in the early 1970s as a way of making pictures of biological structures. Several academic laboratories, of which one of the most committed was at the physics department of the University of Nottingham, investigated the original idea, developed a number of imaging methods and constructed prototype imaging spectrometers to assess the practicality of imaging humans. Initial results through the mid-1970s were of such poor quality that they were medically rather uninteresting although they served to demonstrate the feasibility of making pictures with nmr. Commercial involvement by the major medical imaging manufacturers in the late 1970s accelerated the technological development and produced images of human anatomy that were of obvious clinical value. Projections are now being made that nmr imaging will be a billion-dollar industry and will possibly replace one-third of the use of medical x rays.

NMR Imaging in Biomedicine by Peter Mansfield of Nottingham University and P. Morris of the National Institute for Medical Research in London serves as an excellent introduction to the physicist who wishes to move into this new area of research. This book contains by far the most complete description of the physical and mathematical bases of nmr imaging methods. Mansfield and Morris describe many of these from the practical perspective of Mansfield's own research on these methods. They present a number of practical hints and warnings along with a formal analysis of imaging methods. The discussion of the medical applications of nmr imaging, much less satisfying, shows a lack of appreciation of the goals and needs of medical imaging. However, it is probably premature to attempt to put nmr imaging into clinical perspective because the answers about medical efficacy are not yet known. In an excellent chapter on biomagnetic effects they give a thorough discussion of the possible sources of hazard to the patient.

Nuclear magnetic resonance spectra from within living subjects are opening new windows onto *in vivo* biochemistry and metabolism. While the medical application of this technique is not yet as dramatic as imaging, it is being applied clinically and may well be the major contribution of nmr to medicine.

David Gadian of Oxford University has written *Nuclear Magnetic Resonance and Its Applications to Living Systems* for biologists with no prior nmr experience to convince them that nmr provides unique and valuable information about living systems and to assure them with a gentle introduction that nmr technology is not beyond their mastery. The first half of the book discusses the kinds of information that can be obtained from H^1, C^{13} and P^{31} spectra of living systems. Probably the most fascinating spectra are those from phosphorus, where the identification of ATP, phosphocreatine and inorganic phosphate levels can permit an assessment of the energetic status of tissues. Some of the discussions of the relation of these measurements to other biochemical assays such as freeze clamping become rather technical and detailed for a physicist not involved in this specialty. The latter half of the book is an introduction to nmr with a particular sensitivity to the problems of *in vivo* measurements. The final chapter provides a good discussion of the particular problems of probe design for live samples. The introduction to nmr is too qualitative and descriptive to be of much use to other than the starting physicist, but it is excellent as an introduction for medical or biological researchers.

It is difficult for books that are written while a field is rapidly changing to have a balanced perspective and to make contributions that will not become rapidly obsolete. These two books, however, succeed and make major contributions as the best texts now available for physicists who want to learn about the blossoming of nmr into medicine.

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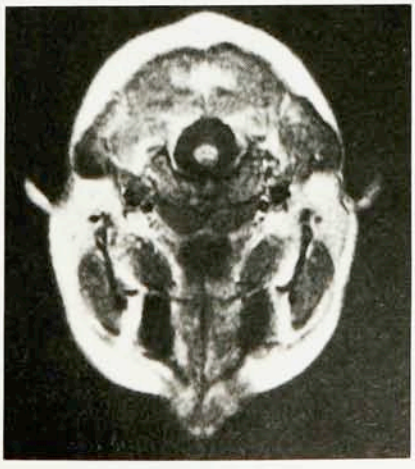
R. Mark Henkelman, whose research concerns medical imaging, is associate chairman of the department of medical biophysics, University of Toronto.

A human head (transverse section) in an nmr image provided by Technicare Corporation.



Scientific Basis of Medical Imaging
P. N. T. Wells, ed.
Livingstone, New York, 1982. $55.00.

In the past decade, medical imaging has gone beyond the x-ray-film age to the computer age. Researchers have developed new modalities for imaging internal structure and function of the living human body almost yearly; many professionals, even in the field of