

the advantages of radionuclides compared with UV/Vis detection in HPLC. They also describe the separation of radionuclide-labeled metallofullerenes in laboratory rats, which is of interest for tomography studies. The authors consider the questions of how the fullerene cage accelerates the decay of the included ion, and describe how a new endohedral fullerene can be formed by β -decay. For example, the decay of ^{155}Sm can result in a europium-containing metallofullerene which is stable. It is interesting that the redox state of the included ion can be changed by radioactive decay; how this affects the chemical stability is not yet fully understood. However, it can be said that in general a change in the redox state of a fullerene leads to instability. Furthermore, metallofullerenes undergo changes as a result of neutron activation analysis, and their redox state is also altered. This chapter illustrates the great possibilities of using radioactive isotopes in fullerene research, but the methods are little used, for reasons that are not discussed here.

The second part of the book is concerned with the structures of fullerenes in solution. It is dominated by an article by Asmus and Guldi on irradiation studies of fullerenes, with the main emphasis on C_{60} . This is known to be an efficient free radical scavenger, and therefore the possibilities for electron-transfer studies are mainly limited to fullerenes in host-guest compounds, since otherwise the free-radical reactions predominate. A further complication in studying the chemistry of irradiated fullerenes is the formation of fullerene clusters. It is largely because of these difficulties that irradiation studies of fullerenes have not progressed very far, and are at present completely overshadowed by photochemical studies, a fact that the authors of the article have taken into account in their most recent work.

The third part is devoted to endohedral fullerenes, and begins with an article by Gadd on endohedral rare-gas fullerenes. The editor and his co-workers contribute an introductory discussion of the importance of this special field of research, and this is followed by a report on neutron activation studies of rare-gas fullerenes. The evidence for the endohedral nature of the rare gases is presented

carefully, but this is ultimately seen to be of an indirect kind, as it depends on an HPLC separation. Ohtsuki and Ohno then report isotopic labeling studies on endohedral fullerenes and heterofullerenes. These mainly involve C_{60} metallofullerenes, which were previously found difficult to isolate using other methods of preparation. The molecular dynamics models for the formation of endohedral fullerenes presented here are not very convincing, as they assume that penetrating metal atoms interact only weakly with the fullerene cage. Moreover, the discussion of metal-containing heterofullerenes that follows shows that much more work is still needed on elucidating the structures of fullerenes. Masumoto, Ohtsuki, and Shikano describe radioisotope labeling of fullerenes with ^{14}C and ^{15}N , which offers an interesting but expensive route to new fullerene structures, the evaluation of which is a matter for the future. The following chapter on fullerene radiopharmaceutical agents is only three pages long, and is thus too short to be usefully discussed.

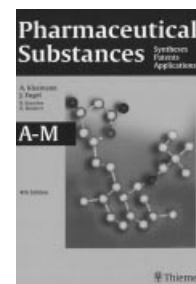
Lastly, in the fourth part of the book, Braun and Rausch describe the determination of trace impurities in fullerenes by neutron activation analysis. That is a difficult task when one considers the wide variety of impurities present in the graphite used as the starting material. One has to beware of making general statements about this, even though someone experienced in the preparation of fullerenes can, on the basis of the proportions of elements found in the fullerene samples, form conclusions about the manufacturers' (usually secret) processes.

The book, which has been produced with a high standard of typography, paper quality, and binding, is completed by a brief subject index. The work is an essential addition to the bookshelves of everyone who is engaged in research on fullerenes and wishes to be well informed.

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Pharmaceutical Substances. Syntheses, Patents, Applications. 4th Edition. Two volumes. By Axel Kleemann, Jürgen Engel, B. Kutscher, and D. Reichert. Georg Thieme Verlag, Stuttgart 2000. 2488 pp., hardcover DM 998.00.—ISBN 3-13-558404-6

A common problem encountered by the pharmaceutical chemist is that of coming across an unfamiliar International Nonproprietary Name (INN) and needing to know the chemical structure. The work reviewed here lists over 2000 INNs with their structures



and relevant information, and even the most knowledgeable pharmaceutical chemist cannot be expected to be familiar with all these. Asking a subordinate or colleague can be rather embarrassing for both parties, and often does not help. However, if one owns the Kleemann encyclopedia, one at least knows where the information is likely to be found, and can then usually answer the question easily and with confidence, without needing to worry about uncertain networking connections, the niceties of how someone must be approached, or rights of access. The alphabetical arrangement of the INNs gives rapid access to the required basic chemical and pharmaceutical information. Synthetic routes to the compound are also clearly described, which is an advantage compared with other reference sources. Thus, the encyclopedia is especially interesting and valuable for the organic chemist who needs to get a quick first impression about a compound.

In order to access the information quickly through the alphabetical list, it is essential to know the exact INN. If one needs to find a synonym one can refer to the "Alphabetical List of Drug Monographs". There is another index that allows one to search under trade names. The different types of names are kept strictly separate, a commendable system which contrasts with the rather loose practices typical of many publications, where original papers often give a trade

name instead of the correct INN. Indexes of "Substance Classes" and "Intermediates" are also provided, and can be useful in special cases. However, where none of the search methods mentioned above leads to the desired goal, the CD-ROM version of the encyclopedia may provide the answer; this was not available to the reviewer.

As well as targeted searches, which for some time now have been moving into the domain of electronic media, this work allows the possibility of looking at compounds from a pictorial standpoint, so that the organic chemist can try to develop and exploit the "organic chemist's eye" for recognizing the hidden patterns that enable one to distinguish pharmacologically successful active agents from the rest. The alphabetical arrangement of the active agents may allow the scientist with an eye for patterns to develop a broad visual perspective extending over the indications. Anything that helps one towards achieving this highly desirable aim is always welcome. Therefore, it makes good sense for groups working on pharmaceutical chemistry to buy this work.

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The Chemistry of Contrast Agents in Medical Magnetic Resonance Imaging. Edited by *André E. Merbach* and *Éva Tóth*. John Wiley & Sons Inc., New York 2001. xii + 471 pp., hardcover £ 110.00.—ISBN 0-471-60778-9

The Chemistry of Contrast Agents in Medical Magnetic Resonance Imaging, compiled by André Merbach and Éva Tóth, is a book devoted to the physicochemical aspects of paramagnetic and superparamagnetic contrast agents with potential application for magnetic resonance imaging (MRI). More than 30 authors have contributed their exper-



tise, which has been arranged in eleven self-contained chapters with minimal overlap.

The book begins with an introduction to the phenomenon of nuclear magnetic resonance (NMR). Using a combination of classical and quantum-mechanical descriptions, numerous aspects ranging from energy levels to relaxation, *k*-space, and instrumentation are discussed, followed by a classification of contrast agents and some examples of their applications in medical MRI. Chapter 2 describes the theory of relaxivity of gadolinium(III) complexes. Factors determining relaxivity are discussed extensively, with special reference to the mechanisms of inner and outer sphere relaxation. This rather theoretical discourse is followed by two chapters which describe in detail, with cookbook-style recipes, the chemical syntheses of a vast number of acyclic and macrocyclic ligands suitable for complexation of gadolinium(III). The following two essays examine how relaxation times are affected by covalent and noncovalent bonding of such gadolinium(III) complexes to macromolecules, and discuss toxicity issues related to the use of gadolinium-based contrast agents in vivo. The stability and kinetic inertness of different lanthanide–ligand complexes are discussed with regard to possible decomplexation and release of noxious gadolinium(III). Next there is a discussion of the current status of computational studies aimed at modeling and predicting the relaxivity of contrast agents. An entire chapter is devoted to the elucidation of structure and dynamics of gadolinium(III)-based contrast agents by techniques including X-ray methods as well as ^1H , ^{13}C , and lanthanide nucleus NMR spectroscopy. Two further chapters report on electron paramagnetic resonance (EPR) and photophysical methods as complementary techniques for structural and functional studies of gadolinium(III) chelates and of analogous luminescent lanthanide complexes, respectively. A final chapter provides, an excursion into the synthesis and properties of particulate superparamagnetic iron oxide. The effects of particle size and degree of aggregation on relaxivity are discussed.

As promised on its cover, this book provides a uniquely comprehensive

treatment of the physicochemical aspects of MRI contrast agents based on gadolinium and particulate iron oxide. Packed with information, it is an invaluable resource, especially for physicists and chemists involved in the development of MRI contrast agents. However, biologists, physicians, and readers unfamiliar with the field of MRI will find the discussions difficult to follow, as they are heavily physics- and chemistry-oriented. More practical biomedical aspects are treated only marginally, so that seemingly simple questions such as which contrast agent is best suited for a certain (nonstandard) application remain hard to answer. Also, target-specific and "smart" contrast agents are only mentioned briefly, even though these topics have recently attracted major interest and have become very active areas of research. Seen from a more general stance, it is Chapter 1 that doesn't fully convince with its discussion of the physics of medical MRI. It fails to provide the intended all-encompassing introduction to magnetic resonance. In its place, a well-focused exposition of magnetic resonance phenomena pertinent to relaxation would have been more appropriate. Notwithstanding these limitations, the present book is highly recommended as a thorough survey of the current understanding of synthesis, performance assessment, and theory of gadolinium- and iron oxide-based contrast agents for MRI applications.

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Value Creation. Strategies for the Chemical Industry. Edited by *Florian Budde*, *G. A. Farha*, *H. Frankenmölle*, *D. F. Hofmeister*, and *K. Krämer*. Wiley-VCH, Weinheim 2001. xx + 222 pp., softcover € 69.00.—ISBN 3-527-30251-4

The theory expressed around 1700 by the quack doctor and butcher-dentist Dr. Eysenbarth of Hannover that "Viel hilft viel" (a hefty sum of money

