

BOOK REVIEW

THE SYNTHESIS OF CARBON-11, FLUORINE-18 AND NITROGEN-13 LABELED RADIOTRACERS FOR BIOMEDICAL RESEARCH

JOANNA S. FOWLER and ALFRED P. WOLF, Sept.1982 pp.124. Pub. Technical Information Center U.S. Department of Energy, Oak Ridge, Tennessee, USA. Nuclear Science Series NAS-NS-3201 (DE82014870). Price \$11.25.

This monograph, the first in series of selected topics in the Nuclear Medicine Series, is concerned mainly with the organic (and biochemical) synthesis of compounds labelled with the short half-life positron emitting radionuclides ^{11}C , ^{18}F and ^{13}N . The monograph, in addition to six main sections, has two important Appendixes, the first providing a guide to the literature of organic syntheses in general and the second a guide to the literature on organic syntheses with positron emitters in particular. After a general introduction relating the physical properties of the three positron emitters and their importance in positron emission transaxial tomography (PETT), the general considerations in the design of radiotracers are discussed. This includes the choice and position of the label pertaining to the use of the radiotracer, which of course are fundamental considerations for any studies with tracer compounds.

The arrangement of the text in the next section on Radiotracer Synthesis may have been improved by not confronting the reader so early with tables of labelled compounds. This section considers the synthetic strategies to be adopted, the availability of appropriate precursors, optimisation of reaction rates, specific activity and stoichiometry. When expressing yields and specific activities the Authors rightly draw attention to the use of EOB (end of cyclotron or accelerator bombardment) and EOS (end of synthesis) as reference points, thus eliminating ambiguities relating to synthesis time for example. Biosynthetic tactics are also reviewed in this section including the well established uses of photosynthesis and enzymes; the use of immobilised enzymes is also especially highlighted. The section is concluded with a useful discussion of purification and quality control of the prepared radiotracers with especial reference to the use of HPLC. The Tables referred to above, list precursors of ^{11}C , ^{18}F and ^{13}N for use in syntheses, give listings of ^{11}C (149), ^{18}F (83) and ^{13}N (20 especially amino acids) labelled compounds with appropriate references, prepared by direct chemical synthesis

and by enzymatic methods. The next three sections of the monograph discuss in more detail the synthesis of ^{11}C -, ^{18}F - and ^{13}N -labelled compounds amply illustrated with a selection of examples. The 10 minutes half-life for ^{13}N presenting unique problems in the synthesis of compounds labelled with this radionuclide. Aromatic fluorination, substitution of fluoride in aliphatic compounds and electrophilic fluorination are the three main methods described in the section on labelling with ^{18}F .

The final section is on experimental design and related technology with three good examples chosen to illustrate specific points, namely the synthesis of [^{11}C]imipramine, [^{11}C]palmitic acid and 2-deoxy-2-[(^{18}F]fluoro-D-glucose. The need for the radiochemical laboratory to be in close proximity to the metabolism or functional laboratory and the cyclotron/accelerator for PETT studies are discussed as also are radioactivity measurement methods and shielding requirements.

The bibliography listing of 496 references with topic titles and a subject index complete the text of the monograph.

Overall the monograph is well written and produced and in the main meets the purpose of the text stated in the Foreword *viz.* "to provide information of practical value to the laboratory scientist". The monograph is packed with information and references and is a very timely publication as more studies are being carried out using PETT, made possible by the more widely available small production cyclotrons and accelerators.

At the list price the monograph is excellent value and provides interesting general reading for chemists and students as well as for the specialist radiochemist.

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