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RECENT ADVANCES IN THE CHEMISTRY OF POSITRON EMITTERS

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There are at present approximately 60 institutions world-wide equipped with some type of charged particle accelerator, preponderantly "small medical cyclotrons" associated with one or more positron emission tomographs (1,2). The use of positron emitters in labeled compounds for biomedical research all but disappeared post World War II, being displaced by carbon-14 and tritium in biochemical and biological research, and by the single photon emitters primarily iodine-131 and technetium 99m in biomedical research and clinical practice. Following the introduction of a "medical cyclotron" at Hammersmith Hospital in London a number of papers again began appearing utilizing single oxygen-15 and carbon-11 labeled compounds. In 1966 a paper appeared which served as a renewed stimulus to considering positron emitters for research and clinical use (3). As the positron emission tomograph allowing quantitative determination of radionuclide (or positron emitter labeled compound) concentration in a given volume element of tissue in vivo became more readily available in the early and mid-seventies, the opportunity to use increasingly sophisticated labeled compounds and labeled biomolecules manifested itself. Compounds labeled with carbon-11, nitrogen-13 and fluorine-18 described in the literature prior to 1981 have been documented in a book on synthesis methods (4). Somewhat more recent reviews can be found in a number of book chapter (5a,b). However, no extensive review of new labeled compounds is available covering published work of the last three years. It is not the purpose of this short paper to present such a review but rather to present some of the more recent trends in labeling compounds with positron emitters.

Beginning with carbon-11 the traditional methods of preparing ^{11}C-methanol from $^{11}CO_2$ and the use of the carboxylation of a Grignard with $^{11}CO_2$ have been applied with advantage in preparing a host of labeled ethers, alcohols, ketones and hydrocarbons for use in studying the relationship between lipophilicity and brain extraction (6).

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