

D

FLUORINE-18 CHEMISTRY AND ITS APPLICATION TO POSITRON EMISSION TOMOGRAPHY

A. P. Wolf

Department of Chemistry, Brookhaven National Laboratory, Upton, NY (U.S.A.)

The decay properties of fluorine-18, $t_{1/2} = 110$ min, 97% β^+ emission, $\epsilon_{\max} = 0.65$ MeV, make it a near ideal tracer for use in positron emission transaxial tomography (PETT). The application of fluorine-18 has mainly been as a tracer in biologically active compounds in biomedical research. These include compounds where its position in the molecule is chosen to be biologically inactive, where its position is chosen to block a specific biochemical pathway or where it replaces fluorine-19 in the compound of interest. The synthetic challenges presented by working with no carrier added (NCA) or "carrier free" (CF) fluorine-18 have both similarities and differences from work with "normal" fluorination reactions. The broad scope of organofluorine chemistry is limited when dealing with fluorine-18 synthesis. The major factors to consider are the time scale of the synthesis, normally taking no longer than one to four hours for any single or multiple step procedure, the precursors available, they must have high specific activity and be readily preparable e.g. $^{18}\text{F-F}_2$, anhydrous H^{18}F , aqueous $^{18}\text{F}^-$, and the synthetic procedures which must result in yields adequate to the needs of the biomedical research. The lecture will cover the most useful preparative methods for the radionuclide and simple precursors, the precursor field in general, synthetic strategies utilizing the electrophilic or nucleophilic character of the labeled reagent, some specific examples such as the metabolic agent 2-deoxy-2- ^{18}F -fluoro-D-glucose, neuroreceptor ligand agents such as ^{18}F -spiroperidol (spiperone) and others, ^{18}F -labeled nucleosides, steroids, fatty acids and other compounds. Some examples of applications in biomedical research will be given and present and future challenges in research with this nuclide will be addressed in the context of its chemical and radiochemical properties.

Research carried out at Brookhaven National Laboratory under contract with the U. S. Department of Energy.