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$^{18}$F-FDG is a useful radiopharmaceutical to determine the cerebral metabolic rate of glucose using computerized emission tomography, and the theory by Sokoloff et al is generally used in this technique. Since this method can only represent the metabolisms in local areas of the brain, the metabolisms of each compartment (e.g. neurons, glial cells and brain microvessels) cannot be measured. Compartment analysis is more important to understand the brain metabolism than the analysis of whole brain so that each compartment should be defined.

In this present experiment, $^{18}$F-FDG metabolic rate of rat brain microvessels vs. whole brain was obtained by the isolating brain microvessels according to the method of Brendel et al. FDG-6-P activities of both microvessels and whole brain were approximately 0.093 and 0.974 (% dose/g tissue) respectively at the time of 30 minutes after injection. Rackl et al show the volume of microvessels in the brain was calculated to be about 2.1%. So the distribution ratio of FDG-6-P in the rat brain microvessels vs. whole brain can be estimated to be 0.204.

This value suggests a fact that, under the normal conditions, FDG metabolism in rat brain microvessels must be a negligible factor in that of whole brain.


[11]S-Adenosyl-L-methionine (SAM) is expected to be a new positron-emitting radiopharmaceutical as a tracer of the transmethylation.

The concentration of [11]S-methionine (Met) by the method of Gueguen et al (J. L. C. R. 1981 157) with some modifications. The [11]S-Met was synthesized with [11]S-Chol and L-homocysteine thiolactone. Rat liver extract was the fraction precipitating with 33-50% saturation of (NH4)2SO4 and was used as an enzyme source without further purification. The mixture of [11]S-Met, 10 μM ATP, liver extract, 100 mM MgCl2 in 100 mM triethanolamine acetate (pH 8.2) was incubated at 37°C for 10 min. After incubation, the mixture was acidified with HCl to 3% and the denatured protein was removed by centrifugation. The supernatant was loaded on Sephadex C-25 to remove the unreacted reagents. The [11]S-SAM was eluted with 1M HCl, evaporated to dryness and dissolved in saline. The [11]S-SAM was obtained in a radiochemical yield of about 42% and a radiochemical purity of more than 94% within 72 min.

The results of the tissue distribution study of the [11]S-SAM in tumor (AH109A)-bearing rats were as follows; the clearance of radioactivity from the blood was slow, but as a high rate of blood flow rate, but as a high rate of yield is required owing to the short half-life, its radio exposure poses a problem. It was confirmed that the newly-developed synthesis system could synthesize $^{13}$H at a high rate (600 mCi at 60 min; d=50 μA, 5 min.) as a result of synthesis tests using small medical cyclotron (CYPRESS). As $^{13}$H is trapped automatically into a Pb-shielded vial, radiation exposure is sizably diminished. Moreover, as it does not incorporate the conventional bubbling system for recovery of $^{13}$H, it greatly eases the recycling production and system cleaning.


Among the positron emitting radionuclides, $^{18}$F is a very useful nuclide in nuclear medicine. Molecular fluorine ($^{18}$F) is routinely used for the synthesis of 2-fluoro-2-deoxy-glucose (FDG). Another chemical form of fluorine, $^{18}$F, is also important in the labeling of biomedical materials. We have designed a compact target box equipped with a heater and a thermocouple and constructed a remote-controlled target system. $^{18}$F was produced by $^{18}$O(n,d,x) reaction with 7.5 MeV deuteron beam of mini-cyclotron. Anhydrous $^{18}$F was recovered under hydrogen flow at around 500°C. Up to 48% of $^{18}$F was recovered compared with thick target yield. Target system was designed to prevent explosion and can be controlled by remote control panel or micro computer system.


$^{11}$H has a potential for clinical application, such as for measurement of blood flow rate, but as a high rate of yield is required owing to the short half-life, its radio exposure poses a problem. It was confirmed that the newly-developed synthesis system could synthesize $^{11}$H at a high rate (600 mCi at EOS; d=50 μA, 5 min.) as a result of synthesis tests using small medical cyclotron (CYPRESS). As $^{11}$H is trapped automatically into a Pb-shielded vial, radiation exposure is sizably diminished. Moreover, as it does not incorporate the conventional bubbling system for recovery of $^{11}$H, it greatly eases the recycling production and system cleaning.