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THE DEVELOPMENT OF THE APPARATUS FOR THE FULLY AUTOMATED SYNTHESIS OF [C-11]METHYL IODIDE

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[C-11]methyl iodide is a potentially useful precursor for the synthesis of [C-11]-radiopharmaceuticals. The apparatus for the automated synthesis of [C-11]methyl iodide has been developed.

The apparatus consists of the programmable controller, the temperature controller and the operation units. It automatically controls the following synthetic procedure; 1)[C-11]carbon dioxide is adsorbed on Molecular Sieve 4A, 2)[C-11]carbon dioxide is released from MS 4A by heating and introduced into the vessel containing $LiAlH_4$/THF cooled at -20°C under a He flow, 3)THF is evaporated off at 70°C under the reduced pressure, 4)water is injected into the vessel to form [C-11]methanol, 5)[C-11]methanol and water are transferred into the boiling HI solution by heating at 100°C under a He flow, and 6)[C-11]methyl iodide formed in the HI solution is passed through a sodalime and P_2O_5 column and collected in a cold solvent.

The apparatus has demonstrated that the synthesis is completed within 25 min after the irradiation with radiochemical yield of 50-70 %. The yield has depended on the pretreatment of MS 4A and the preparation of $LiAlH_4$/THF.

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THE DEVELOPMENT OF THE PRODUCTION SYSTEM OF [F-18]-LABELED GASES.

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[F-18] is a potential positron emitter for cyclotron nuclear medicine. The production system of [F-18]-labeled gases has been developed for the synthesis of [F-18]-radiopharmaceuticals. It is remotely controlled for rapid and safety handling of radioactive gases in a quantity of more than several hundred mCi of [F-18].

F_2[F-18], one of the useful labeling precursors, is produced by the deuteron bombardment of the Ne gas containing 0.1 % of carrier F_2 filled in the Ni chamber (ϕ2.5 × 20 cm) under the pressure of 25 kg/cm^2. It has proved that about 80 % of [F-18] is constantly recovered from the chamber as F_2[F-18] and it is used for the routine synthesis of [F-18]-compounds such as FDG[F-18], FUra[F-18], FUrd[F-18] and FdUrd[F-18].

The production of HF[F-18], another useful labeling precursor, has been carried out using the pure Ne as the target and the chamber made of copper or stainless steel. After the irradiation, H_2 is introduced into the chamber and [F-18] adsorbed on the wall is recovered as HF[F-18] by heating the chamber at 500-800°C. The chamber material and the temperature were examined for optimal conditions of the HF[F-18] recovery.

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UPTAKE OF Ga-67 IN THE LIVER-DAMAGED RATS.

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The uptake of Ga-67-Citrate was studied in the injuried rat liver treated with chemicalcarcinogens or hepatotoxins, correlating with the biochemical changes in the liver. During hepatocarcinogenesis induced by 3'-Methyl-4-dimethylaminoazobenzene,Ga--67 accumulation in the liver was elevated in a biphasic manner. This change was in good accord with the patterns of the marker enzymes in cancer, the hepatic γ-glutamyltranspeptidase and glucose-6-phosphate dehydrogenase(G-6-PDH)activities. An increase of Ga-67 accumulation in rat liver was also observed in hepatocarcinogenesis induced by 2-Acetylaminofluorene. To obtain more information on the relationship of uptake of Ga-67 and biochemical changes in the liver, we investigated the acute injuried liver treated with CCl_4, thioacetamide or allylformate. In result, uptake of Ga-67 in the liver elevated 2 to 3 times in the recovery from the injuried liver. More over this elevation occured with the changes of liver G-6-PDH activity and DNA synthesis. According to these results, uptake of Ga-67 in the liver-damaged rats appeared to be closely correlated with the induction of hepatic G-6-PDH and the rate of DNA synthesis.

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Ga-67 ACCUMULATION IN TUMOR CELLS AND HEPARAN SULFATE.

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We previously investigated Ga-67 accumulation in the liver of rats during chemical hepatocarcinogenesis induced by 3'-Me-DAB, or hepatofibrogenesis induced by hepatotoxins connecting with biochemical changes. As a result, the elevated Ga-67 accumulation was observed in biphasic manner during hepatocarcinogenesis induced by 3'-Me-DAB. As regards the subcellular distribution of Ga-67, a remarkable change was found in 800 x g fraction. On the other hand, uptake of Ga-67 in the liver of rats treated with hepatotoxin was significantly increased during hepatofibrogenesis as a repair mechanism for necrosis. These data suggested that mucopolysaccharides (MPS) not only as the substance of connective tissue, but also as a component on cell suface of plasma membrane might be play an important role in Ga accumulation in tumor cells. To obtain more information, we investigated on the nature of Ga-67 binding with MPS in detail. Results were as follows:

1) About 50% of the total radioactivity of Ga-67 was found in liver MPS fraction.
2) Radioactivity was detected at the position of heparan sulfate.
3) Elevated uptake of Ga-67 in the liver of CCl_4-treated rats was inhibited by aminoacetonitrile or cycloheximide. Thus, heparan sulfate appears to play an important role of Ga accumulation mechnism.

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