and was efficiently high from 30 miuntes to 60 minutes after the injection of Sn-PYP, which an average of 90% was achieved in 19 cases after the interval of 30 min. On the other hand the dose-dependance of injected Sn-PYP was not clarified.

Although there are still many points to be clarified as to binding mechanism of pertechnetate-RBC complex, the in vivo labeling method seems to be able to be used with the sufficient labeling efficiency and technical easiness.

A High Tumor/Blood Ratio Complex of ^{99m}Tc-Bleomycin (Tc-BLM)

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The usefulness of Tc-BLM in tumor diagnosis has been considered to be greatly dependent on the chemical state of labeled complex; this can be controlled by labeling condition, mainly the amount of $SnCl_2$ and pH of the labeling condition. These parameters were studied in detail.

Tc-BLM complex were analyzed by thin layer chromatography (MeOH : 10% NH_4OAc, 1 : 1) and electrophoresis (EP) (pH 7.0 phosphate buffer, 500 V, 1 hr). Tissue distribution was studied with Ehrlich tumor bearing mice.

Studies have shown that a stable Tc-BLM, in which Tc in a tetra valent state, without being hydrolyzed was needed for a high tumor to blood ratio. Hydrolysis of Tc is influenced by the amount of $SnCl_2$ and pH of the labeling solution. So, the use of a minute amount of $SnCl_2$ and its quick addition into the mixture of BLM and $^{99m}TcO_4^-$ is required to minimize the hydrolysis phenomenon. Under this condition, the pH effect is studied and an electrically neutral complex formation is obtained at pH 6.

The neutral complex is stable against hydrolysis. This feature can theoretically be explained; at this pH, according to the pK_a value of BLM, the third N atom of BLM can be strongly coordinated.

In vivo distribution of the neutral complex is analyzed and the highest tumor/blood ratio is achieved (tumor/blood, 2.5 at 3 hr).

It is concluded that this Tc-BLM complex prepared under very strictly controlled condition such as a minute accurate amount of $SnCl_2$ and very narrow pH range is the most valuable one for a clinical use.

The Preparation of ^{11}C-Methyl Iodide and its Use in the Synthesis of ^{11}C-Caffeine

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Caffeine was labeled with ^{11}C using $^{11}CH_3I$ and its distribution in mice was studies.

$^{11}CO_2$ produced in the NIRS Medical Cyclotron in a (p, α) reaction, was reduced to $^{11}CH_3OH$ by $LiAlH_4$. $^{11}CH_3OH$ was converted by HI to $^{11}CH_3I$ which is useful for methylation several groups present in many natural substances. The preparation of $^{11}CH_3I$ was completed in 25 min after the EOB by using the remote-controlled techniques and the radiochemical yield was 64%.

Caffeine was labeled by action of $^{11}CH_3I$ on theophylline. After purification by passing through on a alumina column, ^{11}C-caffeine was dissolved in physiologic saline. The overall time for the synthesis and purification was about 45 min with 40% radiochemical yield. The radiochemical purity was checked by thin layer chromatography on silica gel (solvent : $CHCl_3$: CH_3OH=19 : 1)

and radiogaschromatography.

When injected intravenously in mice, the radioactivity accumulated in blood, liver, kidney and brain. The brain uptake was found to be about 2.5% of injected dose per gram tissue at 5 min after injection. This result suggests that ^{11}C-caffeine may be a useful brain scanning agent.

Large Scale Production of ^{11}C-Methanol—Precursor for ^{11}C-Labeled Organic Compounds

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Though ^{11}C-labeled organic compounds are expected to be very useful for clinical diagnosis, their practical uses are often confronted with difficulties, most of which are attributed to a short half life of ^{11}C (20.34 min). A large scale of precursors have to be produced for their synthesis, followed by the necessity of procedures rapid and remote-controlled techniques. We have made a try on a large scale production of ^{11}C-methanol, one of main precursors, for the purpose of a practical use of ^{11}C-labeled organic compounds.

$^{11}CO_2$ was produced by 9 MeV proton irradiation at 20 μA with the $^{14}N(p,\alpha)^{11}$ Creaction. Immediately after the end of irradiation, $^{11}CO_2$ was transferred in a current of a target gas of N_2 to the reaction apparatus. The synthetic procedures of $^{11}CH_3OH$ from $^{11}CO_2$ are as below. For an introduction of $^{11}CO_2$ into a $LiAlH_4$

$^{11}CO_2 \xrightarrow{(1)} LiAl(O^{11}CH_3)_4$: (1) 19 mg $LiAlH_4$ in 0.5 m*l* diethyl carbitol (0°C)

$LiAl(O^{11}CH_3)_4 \xrightarrow{(2)} {}^{11}CH_3OH$: (2) 0.7 m*l* carbitol (100°C)

solution, two methods were compared: (A) $^{11}CO_2$ was directly introduced into the $LiAlH_4$ solution from a target tube (100 m*l*/min), and (B) $^{11}CO_2$ was first collected in a silica gel trap at −78°C (500 m*l*/min), then released by heating to 170°C and carried by a current of N_2 into the $LiAlH_4$ solution. Carbitol was added to the solution and the temperature was immediately brought to 100°C. The resulting $^{11}CH_3OH$ was carried by a current of N_2 and collected in an acetone trap at −78°C. The purity was examined by radiogaschromatography.

For a large scale production, the method of (B) was superior to that of (A) in a $^{11}CH_3OH$ yield. The performance of the production was completed within 15 min after the EOB. The use of electric valves helped a rapid and remote-controlled synthesis of $^{11}CH_3OH$. The radiochemical yield of $^{11}CH_3OH$ was 74% and its radiochemical purity was more than 99.9%. It turned out that more than 800 mCi of $^{11}CH_3OH$ can be produced if a high pressure target (>10 atm) and a high incident energy (>15 MeV) are used.

The Production of Pure ^{123}I and the Possibility for the Clinical Application of ^{125}Xe

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It is known that ^{123}I has ideal characteristics for the diagnosis of thyroid gland. On the other hand ^{125}Xe is not known so widely, although it seems to be useful for the clinical diagnosis.

Pure ^{123}I without impurities other than <0.2% ^{125}I was produced by the ^{127}I (p, 5n) $^{123}Xe \xrightarrow{\beta^+, EC,\ 2.1\ h} {}^{123}I$ reaction with 60 MeV protons in 1.5 g/cm^2 NaI target. At the same time ^{125}Xe was obtained as by-products. To increase the yield of ^{123}I,