control mice brain/reference ratio. In *ex vivo* imaging, both in hippocampus and frontal cortex region (Ab rich sites) Tg mice have a better retention than control mice. **Conclusion.** Present results, either in *in vivo, ex vivo* or biodistribution assays, showed that ^{123}I-IMPY is efficient for tracing beta-amyloid plaques in AD research.

Technetium-99m pentacarbonylhalides as a new lung ventilation agent

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Aim. There are two ways to diagnose lung diseases using radiopharmaceuticals (RPs): by intravenous injection of an RP (lung perfusion) or by inhalation of a radioactive gas (lung ventilation). Comparison of the results obtained furnishes reliable information on the lung function and structure. The most widely used RPs for studying lung perfusion are macroaggregates and microspheres of albumin labeled with technetium-99m. The lung ventilation is studied using labeled aerosols (*e.g.* Technegas) and radioactive isotopes of noble gases (Xe, Kr) and this procedure requires rather expensive equipment. We proposed a new procedure based on gaseous $^{99m}Tc(CO)_5X$ (X=Cl, Br, I). **Methods.** Synthesis of $[^{99m}Tc(CO)_5X]$ was performed in a high-pressure laboratory reactor. To produce CO pressure, an external CO source was used. To a standard medical vial containing 1-2 mL of a $Na^{99m}TcO_4$ eluate (activity from 0.5 to 2 GBq), KI (10 mg) and H_2SO_4 (0.06-0.12 mL) were added.[1] The vial was nonhermetically sealed with a Teflon ribbon and placed into the high-pressure cell. The cell was closed and pressurized with carbon monoxide to a pressure of 100-150 atm. The cell was kept at 170 °C for 30-40 min and then was cooled to 80-90 °C. At this temperature carbon monoxide was slowly released from the cell through a vial filled with an appropriate sorbent or a reaction flask with an appropriate solvent. The HPLC pattern showed a single radioactive peak with a retention time of 16.4 min. $[^{99m}Tc(CO)_5Br]$ and $[^{99m}Tc(CO)_5Cl]$ were prepared by similar procedure using HBr and HCl instead of a mixture of KI and H_2SO_4. In all the cases synthesis was performed at acid concentration of ~ 1 M. The ventilation tests were performed using $[^{99m}Tc(CO)_5I]$ adsorbed on Teflon chips. The radioactive tracer was evaporated from the sorbent by external heating with hot water and was transferred into a breathing mask with an air flow. The tomograms were recorded on a γ-Camera E.cam (Siemens). **Results.** Our experimental perfusion data showed that $[^{99m}Tc(CO)_5I]$ prepared for the first time in our laboratory is selectively taken up by lung tissues.[2] The percentage of $^{99m}Tc(CO)_5I$ uptake by lungs, calculated per gram of the tissue, exceeds by more than an order of magnitude the uptake percentage in all the other organs, including liver. Taking into account the volatility of $[^{99}Tc(CO)_5I]$ [3], we attempted to transfer $^{99m}Tc(CO)_5I$ into the gaseous phase. Then, using an air flow containing $^{99m}Tc(CO)_5I$, which was evaporated from the Teflon chips, we obtained an image of rabbit lungs. The resulting interior and exterior images of the rabbit lungs are shown in Figure 1. As seen from the figure, due to high uptake of $[^{99m}Tc(CO)_5I]$ in the course of ventilation tests we obtained rather clear tomograms of the rabbit lungs. The data on the respiration dynamics were also recorded. As seen from the above experimental data, this compound will probably be used as a lung ventilation agent. **Conclusion.** Taking into account our previous data on the lung perfusion, the use of $^{99m}Tc(CO)_5I$ for lung diagnostic allows a unique possibility to perform both lung perfusion and lung ventilation test with one and the same compound, which should substantially simplify the diagnostic.

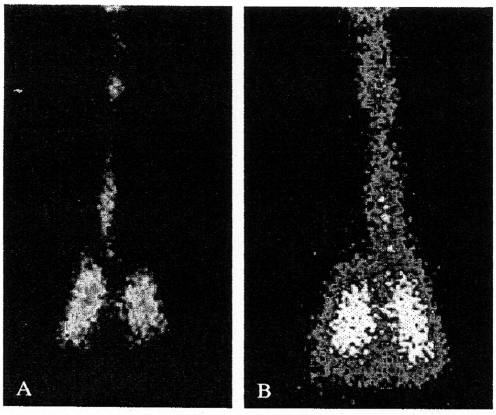

Figure 1.—Ventilation test. A) posterior image; B) anterior image.

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Post-elution concentration of ^{99m}Tc eluted from a gel type generator

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Aim. The radiopharmaceuticals most used in diagnostic nuclear medicine are those labeled with ^{99m}Tc, due to its ideal physical properties of decay ($t_{1/2}$ 6.01 h, Eγ 140 keV), low cost and availability facilitated through the commercial ^{99}Mo/^{99m}Tc generator.[1] The Radiopharmacy Center of the IPEN-CNEN/SP developed a gel type chromatographic generator of MoZr with ^{99}Mo produced by (n, γ) reaction that occurs in IEA-R1 Nuclear Reactor. The gel is composed of zirconium molibdate with elution volume of 10 mL with an activity of 11 100 MBq (300 mCi) producing a radioactive concentration of 1 110 MBq (30 mCi)/mL. The aim of this work is to study a system of post-elution concentration for the attainment of a high enough radioactive concentration, with proved quality. This system of concentration [2] is based on the technique of solid phase extraction (SPE) using commercial cartridges and saline solution (0.9%) or deionized water as eluents. **Methods.** The Zr^{99}Mo gel column generator was prepared using the pre-formed gel technology developed at IPEN. This preformed gel was then irradiated in the IEA-R1 Nuclear Reactor at a flux of 0.8 ~1.2 x 10^{13} n.cm^{-2}.s^{-1} for 2 hours. About 2 g of gel was placed into a glass column and then conditioned by washing with 50 mL of normal saline or deionized water. ^{99m}Tc was eluted with 10 mL of normal saline or deionized water.

The tandem cation/anion or normal phase concentration system consisted of a cation exchange cartridge (Maxi-Clean IC-Ag, strong cation exchanger in Ag^+ form from Alltech) connected at the outlet to the anion-

TABLE I.—*Retention and release of ^{99m}Tc from single cartridges.*

Cartridge	% Retention	% Liberation	Concentration factor
QMA	99±3 (N.=8)	96±4 (N.=8)	1.52±0.09 (N.=7)
QMA light	44±40 (N.=8)	99±3 (N.=3)	1.49±0.06 (N.=3)
SepPak acid	90±11 (N.=10)	88±30 (N.=10)	1.84±0.20 (N.=3)

TABLE II.—*Retention and release of ^{99m}Tc from tandem systems.*

Cartridge	% Retention	% Liberation	Concentration factor
IC-Ag/QMA	100±2 (N.=3)	94±3 (N.=3)	1.55±0.09 (N.=3)
IC-Ag/QMA light	99.99±0.41 (N.=5)	88±5 (N.=5)	1.42±0.07 (N.=5)
IC-Ag/SepPak Acid	99.83±0.41 (N.=6)	89±4 (N.=6)	1.46±0.08 (N.=6)

exchange (Acell™ Plus QMA Light and Acell™ Plus QMA, strong anion-exchanger from Waters) or normal phase (alumina in acidic activity grade from Waters) cartridges. This system of concentration works in 2 stages: one of retention and another one of release of ^{99m}Tc activity. In the retention stage, a solution of $Na^{99m}TcO_4$ coming from the gel type generator, was loaded in the cation cartridge and percolated the anion/normal phase cartridge as well. In this stage, $^{99m}TcO_4^-$ is retained in the anion or normal phase cartridges whereas chloride ions are retained in the cation cartridge. The release is made by eluting $Na^{99m}TcO_4$ from anion or normal phase cartridges with 6 mL of 0.9% saline. A single cartridge system was also studied using anion and normal phase cartridges and eluting the gel with water or saline. All samples have undergone quality control (radiochemical, radionuclidic and chemical purities). **Results.** Table I shows the results of retention of ^{99m}Tc in single cartridges QMA, QMA light and Acid SepPak and further elution with release in 0.9% NaCl solution. ^{99m}Tc was previously eluted from a MoZr gel generator with deionized water. The results of the concentration factor, in 6 mL, are also shown. Table II shows the results of retention and release of ^{99m}Tc from systems in series using the same cartridges used in single system with from gel generator. ^{99m}Tc was previously eluted from a MoZr gel generator with 0.9% NaCl. All ^{99m}Tc eluates were found clear and pH the between 5 and 6, as expected. The ^{99}Mo breakthrough was around 10^{-3}%. The radiochemical purity of $^{99m}TcO_4^-$ was >95% for all the samples. The concentration of chemical impurities – Zr was <5 µg/mL, Mo and Al – was <10 µg/mL each. **Conclusion.** The best and more reliable results for both single and tandem systems were achieved using the cartridge QMA. The main difference between the two systems is that the single one requires the elution of ^{99m}Tc from the gel generator with water, whereas the tandem system can be employed with ^{99m}Tc eluted with saline solution. The system IC-Ag/QMA is the most promising for future automation.

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Synthesis, radiolabelling and *in vivo* tissue distribution of morphine glucuronide

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Aim. The simultaneous determination of opiates and their glucuronides in body fluids is of great practical value in clinical and forensic toxicology. In the case of morphine, this drug is metabolized mainly to morphine-3-glucuronide (M3G) and morphine-6-glucuronide (M6G). M6G shows high affinity for the opioid receptor and exerts corresponding analgesic activity.[1] The aim of this study is conjugation of hydrophilic glucuronic acid (G) to the starting substance morphine and then labelling with ^{131}I using iodogen as oxidizing agent. The reactions were completed at three steps including enzymatic reaction which has sub-steps as following: preparation of microsomal fraction from Hutu 80 cell line, purification of UDP-glucuronyl transferase (UDPGT) from it, estimation of protein amount in microsomal samples, glucuronidation reaction. Morphine was extracted from dry capsules of the opium poppy *(Papaver somniferum)*. It was purified by High Performance Liquid Chromatograph (HPLC) and characterized with Nuclear Magnetic Resonance (NMR), Infrared (IR) spectroscopy and High Performance Liquid Chromatography Mass Spectrometry (HPLC-MS). Biodistribution was determined in male Albino Wistar rats. **Methods.** Synthesis of compound Morphine-glucuronide: In this study UDP-glucuronyl transferase (UDPGT) enzyme was obtained from Hutu-80 Cells. The resulting supernatant was stored at –80 °C until use. The protein content in microsomal samples was estimated using the Bradford method. The protein content was found to be approximately 153.11 mg/mL, which was similar to the value reported by Bradford.[2] The glucuronidation reactions were performed similar with other reports.[3, 4] Microsomal enzyme preparate (6 mg protein/40 µL) was added to 5 mL of 50 mM Tris buffer (pH 8.0) containing 6 mM $CaCl_2$, 10 mM UDPGA and 1 mM dithiothreitol at a temperature of 37 °C. The reaction mixture (total volume 5 mL) containing UDPGT was stirred at 37 °C in a water bath for 10 min. The contents were then sonicated in an ultrasonic bath for 30 s to disperse the microsomes and the reactions were started by the dropwise addition of 2 mg/1 mL morphine in DMSO, with stirring. Slow stirring at 37 °C was continued for 18 hours. The reaction was terminated after 18 hours by addition of 300 µL acetonitrile and the precipitated protein removed by centrifugation at 1 500 rpm for 30 min by using a microcentrifuge. The supernatant was then analyzed by reversed-phased HPLC (Shimadzu 10 AVp). HPLC analysis indicated that the glucuronide yield was over 90%. *Structural parameters*

Structural parameters obtained by NMR and IR spectroscopy and HPLC-MS. *Radioiodination procedure.* Morphine was radioiodinated with ^{131}I using the iodogen method. In order to labeling of morphine with ^{131}I, morphine (1 mg) was added into the iodogen coated tube and then 200 µCi of $Na^{131}I$ was added. This reaction mixture was kept at room temperature without stirring for 15 min. At the end of this time, the mixture was transferred to another tube by a syringe, and then quality control was performed. *Quality controls.* The following quality control studies were done with thin layer radio chromatography (TLRC) and paper electrophoresis to confirm labeling efficiency of ^{131}I-Morphine-glucuronide. *Biodistribution studies in rats.* The biodistribution data are expressed as percentage of injected radioactivity per gram of tissue for some selected organs as the mean value of three rats. For blocking of iodine uptake into the thyroid gland, 10 mg of potassium iodide was added to one liter drinking water of rats. The ^{131}I labeled compound was sterilized by membrane filter and then injected into the tail vein of the animals (1µg ^{131}I-morphine-glucuronide per rat). Then the rats were sacrificed at 15,