for reduced unbound technetium which do not correlate with our clinical findings.

The explanation given for this phenomena by Colombetti, et al. is interesting but according to the manufacturer's directions the strips are supposed to be run individually in their own separate solvent and it is difficult to understand how the acetic acid in the acetone solvent would affect the material running in the saline solvent. A possible explanation for the higher values of reduced unbound technetium indicated in the MAC-1 kit is the transfer of technetium from the relatively unstable Tc-Pyrophosphate to the cellulose contained in the paper of the MAC-1 kit. The stronger chelates of Tc DTPA and Osteoscan do not show as great a disparity between the Michrom and MAC systems. This is consistent with findings on Sephadex column (*2*).

The method we employ entails the use of short, slim ITLC-SG strips (5 mm × 75 mm) which are developed in normal saline to determine reduced technetium, and acetone to determine free $TcO_4$ in water soluble radiopharmaceuticals. Strips of Whatman #1 (7.5 mm × 75 mm) developed in 85% methanol can also be used to determine free $TcO_4^-$ in Tc-Pyrophosphate but produces artifacts when used to analyze Tc DTPA. All systems run very rapidly but still give enough separation to determine relative amounts of free Tc and reduced Tc by scanning on a radiochromatogram scanner which consists of a NaI crystal collimated with a 3 mm sliting lead plate attached to a 3 decade ratemeter and graphed on a TI dual channel recorder. Alternatively, readings may be made by cutting the strip into 1-cm segments and individually counting each section of the chromatogram. For visual determination of the origin, the solvent front progress during development, and final location of solvent front we have found it convenient to place a small dot with an ordinary black felt tipped pen about 1 cm from the bottom of the chromatogram next to the area intended for the application of the sample. Different color patterns will develop in the different solvents allowing quick determination of which solvent system has been used.

The ITLC-SG in normal saline system can also be used for the rapid determination of free Tc in water insoluble radiopharmaceuticals such as Tc MAA and Tc sulfur colloid. The use of these two systems does not involve any extensive preparation and can be rapidly instituted in any Nuclear Medicine Department.

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REFERENCES

*1.* COLOMBETTI LG, MOERLIEN S, PATEL GC, et al.: Rapid determination of oxidation state of unbound $^{99m}$Tc and labeling yield in $^{99m}$Tc-labeled radiopharmaceuticals. *J Nucl Med* 17: 805–809, 1976

*2.* RICHARDS P, STEIGMAN J: Chemistry of Technetium as it is Applied to Radiopharmaceuticals. Presented at the International Symposium on Radiopharmaceuticals, Atlanta, Georgia, Feb. 12–15, 1974

## Reply

We appreciate the interest shown by Kuperus and Lyons in our paper, and recognize that in our explanations for the apparent high content of reduced technetium in phosphorous-based compounds, two facts are combined that are not related. Initially, the explanation of the artifacts produced during the chromatographic testing of these compounds was similar to that of Kuperus and Lyons, however, after reviewing our data, we changed our opinion. Indeed, Tables 1 and 2 (1) show that for all the chromatographic systems mentioned, the content of reduced technetium in labeled phosphorous compounds is larger than expected; nevertheless, the largest content of apparently reduced technetium was found with the MAC kit. These unusually high values for reduced technetium in pyrophosphates, and to some extent in diphosphonate (Osteoscan), cannot be attributed only to the higher instability of these compounds, since both MICHROM and MAC are fast resolving systems providing little time for chemical reactions to take place. This is confirmed by the fact that a much slower system, ITLC, showed the lowest content of reduced species of technetium (Table 1) (*1*). Further tests carried out in our laboratory under different conditions, (including oxygen-free atmosphere in the development chamber, and the use of other nonpolar or low polarity mobil phases) did not improve the testing results.

This is a complex problem, in which instability of these compounds is only a part of it, and that other factors involved create these artifacts. Most probably, the finding of a more suitable combination of stationary and mobil phases will permit one to obtain chromatograms indicating the true state of technetium in these compounds. These chromatograms may also show a closer correlation with the clinical findings.

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REFERENCE

*1.* COLOMBETTI LG, MOERLIEN S, PATEL GC, et al.: Rapid determination of oxidation state of unbound $^{99m}$Tc and labeling yield in $^{99m}$Tc-labeled radiopharmaceuticals. *J Nucl Med* 17: 805–809, 1976

## Increased Salivary Gland Uptake of $^{67}$Ga-Citrate 36 Months After Radiation Therapy

A recent article (*1*) in the *Journal of Nuclear Medicine* discussed the uptake of gallium within the salivary glands after radiation therapy for Hodgkin's Disease. The authors did not indicate how many (if any) of their chronic clinical period cases (2–5 years) were positive. Since the publication of this article we have seen a case of increased activity within the salivary glands in a patient who was 36 months after radiation therapy for Hodgkin's Disease (Fig. 1). This patient was unable to complete his therapy because of consistently low leucocyte and platelet counts secondary to chemotherapy. He therefore received a total target dose of only 2,000 rads to a mantle port in an elapsed time of 3 weeks.

The findings that within the salivary glands gallium uptake may be present for a long period after radiation ther-

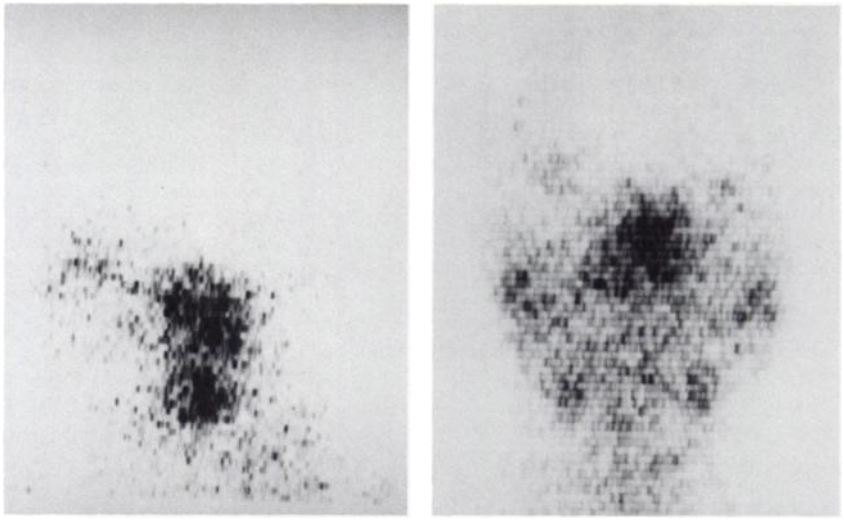

**FIG. 1.** Anterior (top) and right lateral (bottom) gallium scans of head showing increased activity within salivary glands.

apy and also may be found in patients who have received doses less than 4,000 rads made this case informative.

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REFERENCE

*1.* BEKERMAN C, HOFFER PB: Salivary gland uptake of $^{67}$Ga-citrate following radiation therapy. *J Nucl Med* 17: 685–687, 1976

## Reply

We have read with interest the comments concerning our paper "Salivary gland uptake of $^{67}$Ga-citrate following radiation therapy." Although our original series did not include any patients who received less than 4,000 rads, we have subsequently observed salivary gland uptake in patients receiving lower radiation doses to the neck due to interruption of planned treatment and are happy to see the case documented in the preceding letter.

The authors of the letter, however, did misinterpret the section of the original article dealing with the five postradiation scans done during the chronic clinical period (2–5 years). All five scans were positive for salivary gland uptake and, as we originally observed, "The activity in the parotid gland was relatively higher in the scans performed within one year after irradiation . . . No such relative decrease in activity (with time) was noted for the submandibular glands."

We still feel that our report serves to alert physicians to postradiation changes and may thereby avoid false–positive interpretations.

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## Scintiangiographic Visualization of an Occipitoparietal, Extradural Hematoma

In November 1976, the *Journal* reported two cases in which cerebral angioscintigrams contributed significantly to the diagnosis of extradural hematoma (*1–3*). These reports and Dr. Ronai's editorial (*4*) have led us to submit the following case report as additional data supporting the utility of radionuclide dynamic images in detecting an extradural hematoma.

A 36-year-old man fell on a wet floor, striking the occipital region of his head on concrete. Because of persistent nausea and vomiting, occipital headaches, and decreased hearing in the left ear, he was referred to the medical center 4 days after the accident.

Blood was found behind the left tympanic membrane, but the neurologic examination was normal. The pulse rate was 46 and regular. X-rays of the skull showed a left basilar skull fracture. An echoencephalogram showed no midline shift. An electroencephalogram was diffusely irregular and slow, with no lateralization or localization.

On the day after admission, a cerebral angioscintigram and head scan were performed with a scintillation camera. The studies were obtained after intravenous injection of 20 mCi of pertechnetate, preceded by an oral dose of 200 mg of potassium perchlorate to block the choroid plexus. The angioscintigrams were taken in the posterior projection because of the history of occipital trauma and subsequent headaches in that area. The perfusion study was recorded on a computerized data-acquisition and processing system. Photographs of the dynamic images presented on the display were made at 2-sec intervals.

Scintiangiography (Fig. 1) showed decreased activity in the left occipitoparietal region throughout the study. Static brain images were performed at 2 hr, but they showed no definite abnormality. Because of the left occipitoparietal abnormality on the cerebral angioscintigram, an extracerebral hematoma was suspected posteriorly on the left. Similar scintiangiographic findings could have resulted from an occlusion of the posterior cerebral artery or from the presence of a hypovascular intracerebral mass, such as an intracerebral hemorrhage or hypovascular neoplasm.

Cranial computed tomography (Fig. 2) showed a lens-