Of course, an advanced gamma camera system rather than a rectilinear scanner should be used if a valid comparison is to be made with computerized tomographic equipment just a few months off the production line.

The above comments are not meant to belittle the definite advancement in noninvasive imaging represented by computerized axial tomography. However, the definitive comparison of the CTT with advanced cerebral scintigraphy has yet to be made.

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Radiochemical Purity of Technetium Pyrophosphate

In a recent editorial, Eckelman called for more stringent criteria for radiochemical purity (*1*). He proposed as a necessary criterion the demonstration of a single discrete band in two different chromatographic systems, in neither of which the agent remained fixed to the support nor moved with the solvent front. Existing analytical methods often fall short of these requirements. The technetium phosphate bone-scanning agents are a case in point. No analytical methods meeting Eckelman's criterion have been described for these agents.

We have found two column chromatographic systems in which technetium pyrophosphate gives peaks that are neither at the void volume nor at the origin, and thus can demonstrate chemical heterogeneity of the technetium pyrophosphate preparation used routinely in our clinic. The present methods are slow and impractical for routine use, but they yield interesting results and with further development should lead to rapid methods.

The accompanying figure shows two chromatograms of a technetium pyrophosphate preparation. Curve A is the elution profile for a column of Bio-Rad DEAE-cellulose eluted with de-aerated 0.1 *M* $Na_4P_2O_7$ (pH adjusted to 7.0 with HCl). Curve B is the elution profile for a column of Fisher Rexyn CG-3 eluted with de-aerated 0.1 *M* $Na_4P_2O_7$, 0.1 *M* KNO_3 (adjusted to pH 7.0 with HCl). Only the pyrophosphate peaks are shown; the initial portion (including the void volume) and the later portion (including a peak for free pertechnetate) are not included.

Although both methods are based on ion exchange, there is enough difference in substrate (polystyrene vs. cellulose) to perhaps allow distinction as two distinct methods and thereby meet Eckelman's criterion. A method of even higher resolution is desirable, however, since there is a suggestion of a third component preceding the major peak in Curve B. Further development is needed for routine use, aimed at both higher resolution and greater speed. We would appreciate hearing from other investigators of progress along these lines.

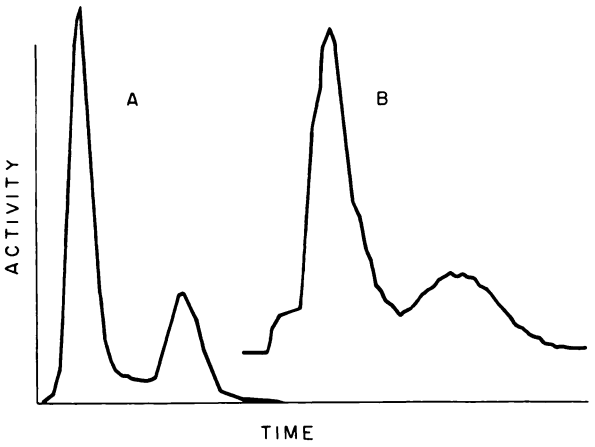

FIG. 1. Chromatograms of technetium pyrophosphate on two different ion-exchange media.

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Calculation of Radioactive Decay with a Pocket Calculator

Radioactive decay is customarily expressed by the equation

$$A = A_o\, e^{-\lambda t}, \qquad (1)$$

where t = time; λ = decay constant in t^{-1} units; A = activity, usually μCi or mCi; A_o = activity at $t = 0$; and e = 2.718 . . . , the natural logarithm base.

However, the decay parameter most readily available is not λ, but the half-life, T. Therefore, the relationship $\lambda T = \ln 2 = 0.693$ . . . is invoked and the decay equation becomes

$$A = A_o\, e^{-0.693\, t/T}. \qquad (2)$$

From this it would appear that the way to calculate A, given A_o, t, and T, is first to determine $x = -0.693\ t/T$ and then to obtain A/A_o from e^x. However, a simplifying feature that is overlooked in this procedure is that $e^{-0.693} = \frac{1}{2}$, and the decay equation may therefore be expressed as

$$A = A_o\, (\tfrac{1}{2})^{t/T}. \qquad (3)$$

Thus, if a pocket calculator having a y^x function is used, A/A_o may be calculated simply by entering 0.5 as y, calculating t/T as x, and calling y^x. This saves several steps when compared with using Eq. 2. For negative values of t, the same procedure works, but alternatively the number 2 may be entered as y and the absolute value of t used.

These procedures are similar to the slide-rule method of setting T against 0.5 or 2.0 on a log-log scale and reading

A/A_o against t, a method now in danger of being forgotten with the proliferation of inexpensive pocket calculators.

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Electrolytic Complexing of Glucoheptonate and Technetium-99m

Recently Chi, Hoag, and Yanchick (*1*) reported in the *Journal* on the 'Electrolytic Complexing of Glucoheptonate and Technetium-99m." We would like to point out a typographical error and make several comments regarding the authors' conclusions.

The typographical error occurred with the listing of a commercial glucoheptonate kit containing 200 g of glucoheptonate. It should have read 200 mg of glucoheptonate.

The apparent advantage that Chi et al. (*1*) propose for their electrolytic glucoheptonate relies on its reported greater stability over the commercially available kits. We have been using commercially available glucoheptonate for more than 2 years, during which time we have prepared approximately 500 vials, and we have not had a vial produce a tag below 95%. In an attempt to determine the reason for the conflict in results, we compared the chromatography systems used by Chi et al. (*1*) with the systems used in our laboratory. We use ITLC-SG in acetone to determine the Tc+7 state and ITLC-SG in normal-saline to determine the unbound Tc+4 state. Two commercially available glucoheptonate kits were reconstituted according to manufacturers' instructions, and the initial chromatographic analysis was performed within 15 min. Further analyses were performed each hour thereafter for 8 hours after reconstitution.

Chromatographic analysis was accomplished by spotting three ITLC-SG strips per vial at each time period. Each strip was N_2 dried before it was placed into either acetone, MEK, or normal saline. Upon completion of development, the strips were allowed to dry and were then counted on a NaI(Tl) well counter adapted with a radiochromatogram-well-adapter designed by Gutowski (*2*). Determination of the percent label was identical to the method discussed by Chi et al. (*1*). The experiment was conducted twice and Table 1 shows the average of the two runs.

Table 1 indicates that neither commercial glucoheptonate kit exhibited any significant breakdown in the eight-hr period whether the solvent system was MEK or acetone. We cannot explain why Chi et al. (*1*) should have found such low labeling yields. Our data in this experiment and our past experience show that commercially available glucoheptonate kits are very stable. We therefore dispute the assertion made by Chi et al. (*1*) that a time-consuming electrolytic production of glucoheptonate offers any advantage over the commercially available system now in use.

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Reply

We are indebted to Gunther et al. for pointing out the typographical error concerning the quantity of glucoheptonate contained in the commercial kit—200 mg, not 200 g.

The data reported in their letter, however, are in direct conflict with the results found in our study (*1*). We, too, cannot explain this difference. Our results were reported exactly as determined, and we did indeed find both a lower labeling yield and reduced stability with commercial stannous glucoheptonate when compared to the electrolysis product. Perhaps the differences reflect kit variability.

Whatever the reason, the differences in results further demonstrate the need for accurate quality control procedures for all radiopharmaceuticals.

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TABLE 1. STABILITY OF COMMERCIAL Tc-99m(Sn) GLUCOHEPTONATE

	% total label after standing time (hr)								
	.25	1	2	3	4	5	6	7	8
Product 1									
A	99.6	99.7	99.3	97.9	99.0	97.6	95.8	97.0	95.0
B	99.2	99.9	98.0	95.7	98.9	97.5	97.8	96.5	93.0
Product 2									
A	98.6	98.0	97.2	95.7	94.9	96.6	96.4	96.2	96.6
B	98.6	98.0	97.2	95.7	94.9	96.6	96.0	96.0	96.5

A. Acetone, Normal-saline. B. MEK, Normal-saline.