and when the sample volume is such that close to 4π geometry is obtained.

The consideration of the decay of Hg-197 is also made somewhat simpler, since there are no K x-rays produced from internal conversion of the 77 keV gamma, and angular correlation effects must be minimal.

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Reply

In my letter to the editor (*1*) I pointed out a fundamental error in a formula by Harper et al. Although their expressions (a) and (b) are correct, expression (c) is not.

This is demonstrated in the special case of 4π geometry, 100% photoelectric detection efficiency, no attenuation, and all photons occurring in pairs cascaded, γ_1 and γ_2, with abundances $\eta_1 = \eta_2 = \eta_{12}$. This means that in formulae (a) and (b) of the referenced paper, $\epsilon_i = \eta_i$ (i = 1,2). For the counting rate in the coincidence peak, however, the following expression holds: $N_{12} = A.\ \eta_{12}$ and *not* according to (c) $N_{12} = A.\ \eta_1 \times \eta_2$, where A is the source activity.

It will be the task of Hudson, Waters, and Davis to explain their procurement of satisfactory results while using an erroneous equation.

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Coincidence-Counting Techniques

A number of letters have recently appeared in this journal (*1–3*) discussing the basis of the coincidence technique as applied to the absolute assay of I-125, I-123, and Hg-197. Van Damme (*1*) has questioned the validity of the use of a random coincidence term in calculating the sum-peak intensity, and has drawn attention to the possibility of angular correlation effects.

Harper and Lathrop (*2*) and Hudson, Waters, and Davis (*3*) have justified the application of their approach to I-125 and to Hg-197, but there appears to be value in amplifying their comments to draw particular attention to the physical situation met in x — γ and in x — x coincidence summing and to contrast this with γ — γ cascade summing.

We may do this by considering the decay of Hg-197 (Fig. 1). More than 98% of the disintegrations proceed via EC_1 to the 77.3-keV level of Au-197. Thus, to an acceptable degree of accuracy, those transitions proceeding via EC_2 may be ignored. Considering the electron-capture process that occurs in EC_1, we should note that this may proceed *either* by K capture, subsequently yielding a K x-ray, *or* by other modes such as L capture, which do not yield a K x-ray. Nonetheless, all these disintegrations lead to the 77-keV level whether or not a K x-ray was emitted in the process. The fraction yielding K x-rays, $\eta_1 = 0.72$.

The decay of the 77-keV state of Au-197 proceeds by the emission of γ_1, which may be internally converted so that the yield of externally detectable gamma photons *per disintegration* is reduced to $\eta_2 = 0.195$. The probability of internal conversion is clearly independent of whether or not a K x-ray was emitted in the previous electron-capture process.

The probability, per disintegration, for the detection of

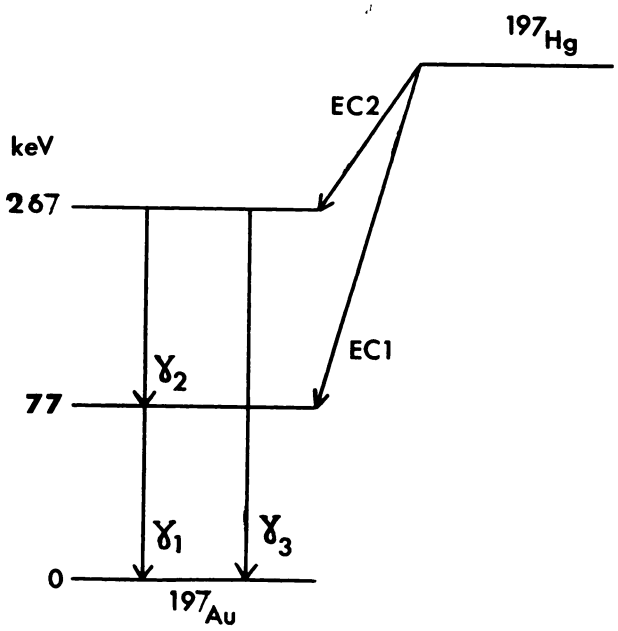

FIG. 1. The decay scheme of Hg-197.