LETTER TO THE EDITOR

In their recent paper, Wood and Levitt (1) have done us a service by demonstrating the suitability of ^{125}I and ^{51}Cr for simultaneous measurement of red-cell and plasma volumes. Simultaneous measurement of the two compartments is surely to be desired in certain patients but appears to be little practiced perhaps because of unfavorable experiences with the ^{131}I-^{51}Cr combination. It would be unfortunate if this were the reason, because ^{131}I and ^{51}Cr with their similar gamma-energies are one of the most difficult pairs to separate by scintillation counting, whereas ^{125}I and ^{51}Cr are particularly easy to assay together. Indeed, I hope to show in this letter that ^{125}I and ^{51}Cr can be handled together with negligible sacrifice of convenience or accuracy compared with single-isotope measurements.

It would seem that Wood and Levitt have not made the most of the inherent advantages of ^{125}I and ^{51}Cr in combination. They use two counting windows which they refer to as condition (1), all pulses accepted above zero pulse-height and condition (2), all pulses accepted above 70 keV. This choice must have been dictated by available instrumentation rather than optimum performance. Its main weakness is the large chromium interference in the ^{125}I channel.

I have found the best counting channels to be two narrow windows centered on the iodine and chromium photopeaks (see parallel-hatched areas in Figure 1). These have the following advantages: (a) each isotope is counted in a balanced window and small drifts of gain do not affect the count rates (b) the count rate

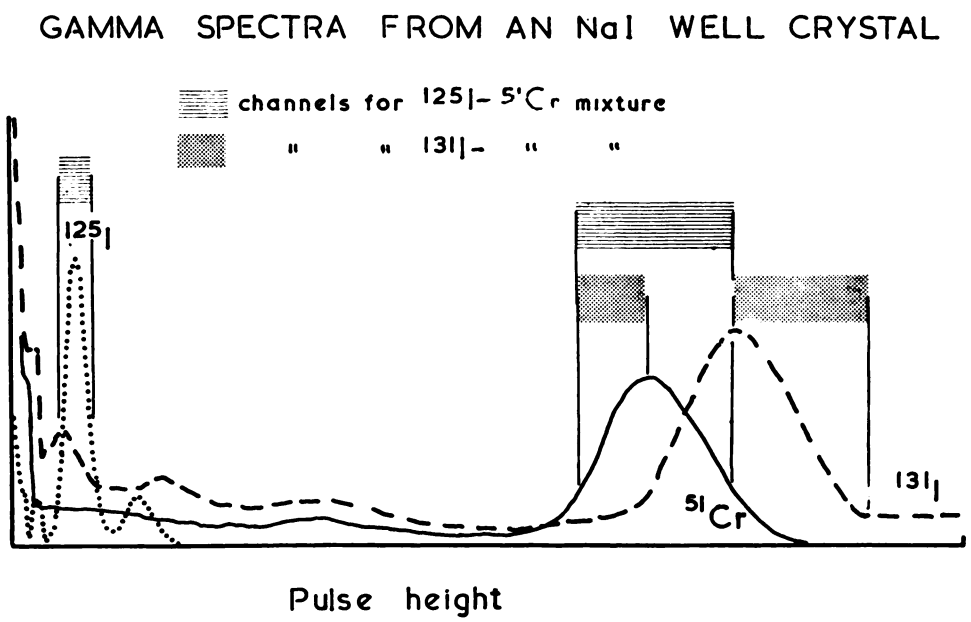

Fig. 1. Gamma Spectra of ^{51}Cr, ^{125}I and ^{131}I taken with a well-crystal. Note low count-rate and absence of peaks from ^{51}Cr in the ^{125}I channel.

in the ^{125}I channel due to chromium is very small (seven per cent of the value in the ^{51}Cr channel is typical) and it too is insensitive to small drifts. In most simultaneous assays of two gamma emitters neither (a) nor (b) can be realised. Iodine-131 and ^{51}Cr are a particularly bad example—see dot-hatched areas of Figure 1.

The curves in Figure 1 were obtained with a Harshaw well crystal feeding a conventional pulse-analyser, ratemeter and recorder[1]. The energy scale is the same for all three isotopes. One should note the very low Compton continuum, devoid of low-energy peaks, in the chromium spectrum. This property, which contrasts with ^{131}I, is due to the absence of photons above about 6 keV in the

TABLE I

STABILITY OF MIXED-ISOTOPE COUNTING
EFFECT OF 0.4% SHIFT OF PHOTOMULTIPLIER VOLTAGE

Isotope Counted	*Change of Count-Rate in Channels Indicated Below Per Cent of Pre-Shift Value*		*Change of Channels-Ratio R Per Cent of Pre-Shift Value*
A. ^{125}I–^{51}Cr COMBINATION. Channels as parallel-hatched in Figure 1			
	^{51}Cr channel 284–360 keV	^{125}I channel 25–40 keV	
^{51}Cr	+2%	−2%	−4%
^{125}I	—	−3%	—
B. ^{131}I–^{51}Cr COMBINATION. Channels as dot-hatched in Figure 1			
	^{51}Cr channel 284–324 keV	^{131}I channel 364–420 keV	
^{51}Cr	+17%	−55%	−60%
^{131}I	+48%	+19%	+80%

[1]Harshaw integral line assembly type 7SF8: well crystal 1¾″ x 2″ with 5 ml nominal capacity well; thickness of crystal one-half inch at sides and below well; Packard model 410AS scaler with sliding-channel pulse-height analyser: Packard model 280 ratemeter and recorder.

lower part of the chromium spectrum. Even the 88 keV lead x-ray which often appears in gamma spectra taken with lead-shielded detectors is not apparent. It is the low, flat nature of the spectrum in the 20-50 keV region, which makes ^{51}Cr particularly acceptable in combination with iodine-125.

The statement made above about freedom from the effects of drift is illustrated by part A of Table I, which summarises the effects of a deliberate 0.4% shift of the photomultiplier voltage, when counting ^{125}I and ^{51}Cr together. This is contrasted with ^{131}I and ^{51}Cr in part B. The channels are those indicated in the figure. Channels–ratio R is defined as:

$$R(X/Y) = \frac{\text{Count-rate due to X in channel set to suit Y}}{\text{Count-rate due to X in channel set to suit X}}$$

X and Y denoting any two isotopes. This makes R ($^{125}I/^{51}Cr$) as just defined the same as K^3 of Wood and Levitt, and R ($^{51}Cr/^{125}I$) the same as $1/K_4$.

The improvement in stability resulting from balanced channels is overwhelming. Indeed the ^{125}I - ^{51}Cr pair are counted with stability equal to that of the system when dealing with either isotope separately. The only likely practical limitations are that the pulse-height-analyser used to define the ^{125}I channel must be stable at the rather low energy settings used, and that this channel must not be subject to spurious pulses arriving *via the power mains.* In addition, if only a single-channel instrument is available its pulse-analyser should be reliably resettable between the ^{125}I and ^{51}Cr channels. Modern apparatus should meet all these requirements.

REFERENCES

1. Wood, G. A. and Levitt, S. H.: Simultaneous Red Cell Mass and Plasma Volume Determinations Using ^{51}Cr Tagged Red Cells and ^{125}I labeled Albumin. *J. Nucl. Med.* 6:433, 1965.

D. Paix, M.Sc.
Hospital Physicist,
The Prince Henry Hospital,
Little Bay, N.S.W., Australia

Mark your calendar now to attend the 14th Annual Meeting of the Society of Nuclear Medicine to be held at the Olympic Hotel, Seattle, Washington, on June 20 to 23, 1967. Please note First Call for Papers on page 727.