of the curves of Fig. 1. However, since 1/P · dR/dt is constant and the plasma curve (P) is exponential, the slope of the renal curve (dR/dt) ought to be an exponential function. The calculation of a mean slope seems to us hazardous.

The second assumption is based on calculations, with and without background correction, in 20 patients with GFR ranging from 9 to 110 ml/min.

Our results are not in agreement with their findings. We have studied 15 renal sets, with separate GFR ranging from 10 to 68 ml/min. For all these patients, different amounts of background, ranging from 0 to 2 background units, were subtracted from the renal curves.

In Fig. 1 we have represented the percentage variations of the separate clearances as a function of the amount of background subtraction. For the 15 patients, the means ± 1 s.d. of the percentage of the variation are shown. It appears that for a wide range of background correction (0.75 to 1.25), slight errors in determining the background do not significantly influence the value of the clearance. For background corrections between 0 and 1, however, differences of as much as 100% can be observed in clearance values.

Since there is no predictable relation between the separate clearance value and the influence of the background curve, the absolute variations of clearance can be important. In one case, for instance, the separate clearance with background correction of 1.0 is 55 ml/min; without correction, it becomes 29 ml/min.

Other authors (*3,4*) have also found significant variations of the background curve.

AMNON PIEPSZ
HUMPHREY R. HAM
ANDRE DOBBELEIR
FRANCOIS ERBSMANN
Saint-Pierre University Hospital
Brussels, Belgium

REFERENCES

1. NIELSEN SP, MOLLER ML, TRAP-JENSEN J: ^{99m}Tc-DTPA scintillation-camera renography: A new method for estimation of single-kidney function. *J Nucl Med* 18: 112–117, 1977

2. PIEPSZ A, DOBBELEIR A, ERBSMANN F: Determination of separate renal clearance by means of Tc-DTPA and a scintillation camera. *Eur J Nucl Med* 1: 69, 1976 (Abst)

3. KENNY RW, ACKERY DM, FLEMING JS, et al: Deconvolution analysis of the scintillation camera renogram. *Br J Radiol* 48: 481–486, 1975

4. DIFFEY BL, HALL FM, CORFIELD JR: The ^{99m}Tc-DTPA dynamic renal scan with deconvolution analysis. *J Nucl Med* 17: 352–355, 1976

Reply

It is true that, in the uptake phase of the Tc-99m DTPA renogram, the slope of the renal curve ought to be an exponential function. For practical purposes, however, it is linear between about 2 and 4 min after the injection. Also, the background, measured between the kidneys or over one cerebral hemisphere, is for practical purposes constant—although careful analysis reveals, not surprisingly, that it does show a small exponential fall. This fall can be disregarded in normal subjects, because it is small compared to the rise of the renal curve when the tracer is given as a slow (30 sec) intravenous injection. Therefore, from about 2 to about 4 min after the injection, $dQ/dt = GFR \cdot P$, where Q is the activity in the kidney area and P the mean plasma concentration.

The letter from A. Piepsz et al. does not provide enough data for us to discuss their arguments in detail. We agree in principle that the subtraction of extrarenal activity combined with blood background correction is right.

The correct estimate of extrarenal activity, however, is difficult to obtain. None of us knows the exact extrarenal activity to be subtracted. We share this problem with those using [^{131}I] Hippuran renography. It might not be wise to use an "area of interest" corresponding to the perirenal region. We feel that Piepsz et al. are on shaky ground in considering that a nephrectomy site truly represents the renal background, since this area is abundantly vascularized for a long time after nephrectomy. Furthermore, two identically located perirenal areas are difficult to produce.

We have demonstrated in our paper that the effect of subtraction of the slope of a curve corresponding to the abdominal aorta on the calculated single-kidney function (SKF) is not great in terms of ml/min GFR. We have also showed that the effect was more pronounced—particularly in patients with low total GFR or low GFR for one kidney—if SKF was expressed in terms of percent of total GFR.

Since we submitted our paper we have carried out 100 additional patient studies. In these patients we have routinely subtracted the slope of the background curve from an "area of interest" between the kidneys.

S. PORS NIELSEN
M. LEHD MOLLER
J. TRAP-JENSEN
Frederiksberg Hospital
Copenhagen, Denmark

Ultrasound as a Complementary Procedure to Radionuclide Thyroid Scanning

We read with interest the article by A. D. and R. C. Sanders in the March issue of the *Journal* (*1*), and agree implicitly that B-mode ultrasonic examination is a useful adjunctive test to the radionuclide thyroid scan (*2*). Such a test may be far less than useful, however, when misinterpreted—as in the case of the thyroid adenoma illustrated in Fig. 15 of that article. The authors demonstrated an example of a thyroid nodule that occupied the lower pole of the right lobe of the thyroid and was shown to be hypofunctioning. The authors stated that the lesion initially appeared sonolucent and occupied the posterior aspect of the right lobe. They did make the point, however, that it was atypical in that it did not exhibit the posterior enhancement of echoes characteristic of cystic lesions. By increasing the gain, they were able to identify internal echoes, and therefore concluded that the lesion was solid.

The lesion illustrated is in fact solid but is located immediately anterior to the proposed nodule. It occupies much of the bulk of the lower pole of the right lobe, therefore appearing quite "cool" on the technetium scan, and it appears to extend into the isthmus. If this were to be normal thyroid tissue displaced forward, as implied by the authors, it is unlikely that this region would appear "cool" on the anterior scan.

Two points should be made. If the presence of a solitary nodule is confirmed by the radionuclide scan, the nodule

should be localized in two planes by performing anterior and the relevant lateral views. In some cases, an oblique view may also be necessary. These precautions will ensure that the lesion is correctly sited within the gland. Second, it is absolutely necessary to adhere to strict criteria in the interpretation of lesions detected by ultrasonic scanning. A cystic lesion should be sonolucent with posterior echo enhancement. The authors correctly used ultrasound at varying levels of attenuation, and indeed this is necessary in confirming the presence of a cyst, since some solid lesions—and in particular malignant lesions—may have sparse echoes of reduced intensity (*3*).

We have used radionuclide scanning and gray-scale echography for the past 4 years as complementary procedures in the investigation of solitary thyroid nodules. During this time we have found this combination of procedures ideal in the preoperative assessment of such lesions, and of greater value than the combination of cesium and technetium scanning, in determining the necessity for surgery (*2*).

We thoroughly endorse the authors' approach to the assessment of thyroid nodules, but would warn that errors of interpretation may be made, unless the above precautions are taken.

ERNEST F. CROCKER
ANDREW F. McLAUGHLIN
GEORGE J. BAUTOVICH
Royal Prince Alfred Hospital
N. S. W., Australia
ROGER F. UREN
American Hospital of Paris
Paris, France

REFERENCES

1. SANDERS AD, SANDERS RC: The complementary use of B-scan ultrasound and radionuclide imaging techniques. *J Nucl Med* 18: 205–220, 1977

2. CROCKER EF, McLAUGHLIN AF, UREN RF, et al: Comparison of caesium scintiscanning with grey scale echography in the investigation of solitary, nonfunctioning thyroid nodules. In *Ultrasonics in Medicine*, Kazner E, ed, Amsterdam, Excerpta Medica, 1975, pp 207–212

3. CROCKER EF, McLAUGHLIN AF, KOSSOFF G, et al: The gray scale echographic appearance of thyroid malignancy. *J Clin Ultrasound* 2: 305–306, 1974

Reply

Review of the original sonogram shows that the lesion in the right lobe of the thyroid is partially echo-free and partially echo-filled; it was correctly reported at the time. The purpose of the figure in our article was to show how, by varying the power output, it is possible to differentiate between a cystic and a solid homogeneous mass within the thyroid. We regret that the labeling on the figure was misleading. Both the area anterior to the solid homogeneous mass and the labeled echo-free area are involved in the neoplastic process.

ROGER C. SANDERS, M.D.
Johns Hopkins University
Baltimore, Maryland

Method to Calculate Activity of a Source from Counting Rates in Single and Coincidence Photopeaks

In 1963 Harper et al. (*1*) published a special γ-spectrometric method to measure the activity of a source. The formula underlying their method reads (in our notation):

$$D = \frac{\eta_1 \times \eta_2}{[\eta_1 + \eta_2]^2} \cdot \frac{[N_1 + N_2 + 2N_{sum}]^2}{N_{sum}}, \qquad (1)$$

where D is the activity (dps) of a source emitting photons γ_1 and γ_2 with abundances η_1 and η_2 at energies E_1 and E_2; N_1 and N_2 are the counting rates in the observed photopeaks at E_1 and E_2 (e.g., produced by a Na(Tl) scintillation spectrometer); and N_{sum} is the counting rate in the coincidence peak at the apparent energy $E = E_1 + E_2$. The special merit of their method is that the true abundances are not required, but only their ratio η_1/η_2, which is less difficult to estimate. Moreover, a relatively large error in this ratio has only a small effect on the result, D, as can easily be verified. Equation (1) is not correct, however, and should be replaced by:

$$D = \frac{g}{G} \cdot \frac{\eta_{12}}{[\eta_1 + \eta_2]^2} \cdot \frac{[N_1 + N_2 + 2N_{sum}]^2}{N_{sum}}, \qquad (2)$$

where η_{12} is the abundance of correlated photons, γ_1 and γ_2, cascaded in pairs. The factor g takes into account the angular correlation between the photons γ_1 and γ_2 (*2*). If there is no angular correlation, g will simply be equal to G, the geometrical efficiency. The result, D, is then independent of the geometry! It will be clear that the advantages of the method no longer exist in its correct version.

The fundamental error—the use of $\eta_1 \times \eta_2$ instead of η_{12}—seems to be caused by confusion of two different types of "sumpeak:"

$$N_{sum} = D \cdot G \cdot g \cdot \eta_{12}, \qquad (a)$$

which is valid when photons γ_1 and γ_2 are emitted in cascade (*3*); and

$$N_{acc.\ sum} = D^2 \cdot G^2 \cdot \eta_1 \times \eta_2 \cdot 2\tau, \qquad (b)$$

which describes the counting rate in the sumpeak due to accidental coincidences ("accidentals") between uncorrelated photons γ_1 and γ_2 (*4*). τ is the resolving time of the detection system.

We have tacitly assumed for both cases the absence of attenuation between source and detector, and a 100% photoelectric detection efficiency for γ_1 and γ_2.

We find the incorrect equation (1) also applied in References *5–8*.

We note three restrictions for the validity of equation (2)—equally necessary if equation (1) had been correct.

1. No attenuation between source and detector.
2. 100% photoelectric absorption of γ_1 and γ_2 in the detector.
3. The incident rate of photons must be sufficiently low to make "accidentals" negligible.

The first and second imply no coincidences between a photon γ_1 and a Compton-scattered γ_2, and vice versa.

If the foregoing three restrictions are met, we have for the single peaks observed:

$$N_1 = D \cdot G \cdot (\eta_1 - g \cdot \eta_{12}), \qquad (3)$$

and