

REPLY

Three questions, other than our simplicity, have been raised concerning the method reported for labeling fibrinogen with ^{99m}Tc . Are other proteins labeled? Is the fibrinogen irreversibly denatured? Will the labeled material work?

Other proteins—chiefly albumin, as determined by electrophoresis—are labeled when a glycine-extracted protein rather than pure fibrinogen is used as a starting mixture. This constitutes approximately 10% of the radioactivity, as determined by zone counting of the electrophoretic cellulose acetate plate. The fraction rises to 15%, incorporating any residual free pertechnetate, when plasma, as we recommend, is used as a buffer for the freshly labeled solution, since protein tagging continues to take place.

Yes, part of the fibrinogen is irreversibly denatured. This is evidenced by (A) the formation of precipitates, (B) the short initial blood-clearance half-time of 150 min in the dog (versus 5.7 hr for ^{125}I -labeled fibrinogen), and (C) accumulation in the liver of a large portion of the dose in rats (more than five times the amount of ^{125}I -labeled fibrinogen), dogs, and man. This is probably related to the low pH of the labeling circumstances.

The crucial question, "Does it work?", may be

answered by examining the pertinent property of fibrinogen—participation in clot formation. Approximately 25% of the labeled substance clots, so our answer is a qualified yes. An initial small trial labeling of a glycine-extracted autologous fibrinogen mixture (from informed consenting patients) suggests that after 18 hr activity does accumulate in areas of active clotting in the legs and in areas of active lower-extremity thrombophlebitis without demonstrable clotting, but not in areas of old clotting. This occurs in spite of denaturation and accumulation of the tagged protein in the liver.

Our purpose in disseminating information concerning an electrolytic means of labeling fibrinogen with ^{99m}Tc is to encourage those with facilities for extensive in vitro and in vivo quality control to evaluate the method rather than to ignore it, thinking that it will not work. It will work and it is simple, although it still may not be the best way to accomplish the labeling.

FRED S. MISHKIN
DENNIS W. WONG
Martin Luther King Jr. General Hospital
Los Angeles, California

COINCIDENCE AND NONCOINCIDENCE COUNTING

Having read the paper "Coincidence and Noncoincidence Counting (^{81}Rb and ^{43}K): A Comparative Study" by Ikeda, Duken, Tillmanns, and Bing (*J Nucl Med* 16: 658–661, 1975), I wish to make the following comments.

The authors did not state what window was used for the ^{43}K experiments. If a wide window (>250 keV) were used to encompass both pairs of ^{43}K peaks, some resolution would be lost due to this technique alone. Moreover, they do not state the distance at which the phantom or excised hearts were "scanned" with their 2-cm single-hole collimator. Naturally, the farther the target from the collimator face, the greater the FWHM. In this instance, FWHM would certainly be more than 2 cm. Using this coarse collimation, they proceed to the observation that "with these results in mind, it is difficult to see how, using noncoincidence counting in the beating heart in situ, any 'cold spots' can be detected using either ^{43}K or ^{81}Rb ." If their observations were correct, then it would really apply to practically all nuclear medicine imaging techniques.

They have provided additional evidence that coin-

cidence counting produces better resolution, but unfortunately positron emitters are not available for all nuclear medicine imaging procedures. Fortunately, equipment with considerable capability can be constructed or purchased. A collimator has been specially constructed for ^{86}Rb (1.08 MeV) and ^{42}K (1.52 MeV) (1). At its focal distance, it can resolve a 2.2-cm-diam hole in filter paper when the phantom was soaked in ^{86}Rb and counting was noncoincidence (2). This phantom was comparable to that of Ikeda et al. Those who are successfully securing myocardial images from scanning would make a list too long for any letter. They must be doing something correctly.

The authors suggest that myocardial scanning should be done while uptake by the heart is constant, but this period is very short after a bolus intravenous injection. A number of years ago, Love proposed the continuously decreasing intravenous infusion as a means of prolonging this period for serial scans (3). Work in this area has continued (4,5).

ROBERT O. SMITH
University of Mississippi Medical Center
Jackson, Mississippi

REFERENCES

1. LOVE WD, SMITH RO: Focusing collimators for use with the hard gamma emitters rubidium-86 and potassium-42. *J Nucl Med* 7: 781-786, 1966
2. SMITH RO: Dot scanning using logarithmic taper and adjacent area averaging. *J Nucl Med* 9: 447-449, 1968
3. LOVE WD, SMITH RO, PULLEY PE: Mapping myocardial mass and regional coronary blood flow by external

monitoring of ^{42}K or ^{86}Rb clearance. *J Nucl Med* 10: 702-707, 1969

4. SMITH RO, LOVE WD, LEHAN PH, et al: Delayed coronary blood flow detected by computer analysis of serial scans. *Am Heart J* 84: 670-677, 1972

5. SMITH RO, BENNETT KR, SUZUKI A, et al: A traumatic evaluation of myocardial revascularization procedures with ^{42}K . *Radiology* 114: 99-106, 1975

REPLY

We used, for convenience, a combined or wide-range window (approximately 410-610 keV), which encompassed the upper energy of ^{43}K .

As for the distance between the target and the surface of the collimator, we maintained it at 30 cm for ^{43}K , as well as for coincidence counting. It is correct that if shorter distances had been employed for the ^{43}K experiments, the resolution would have improved, but with noncoincidence focusing techniques the target-collimator distance is much more important than with coincidence counting. This may cause difficulties in detecting cold spots in patients with thick chests. However, the vertical resolution range of the focusing techniques used by Dr. Smith is superior because of his use of two crystals.

With coincidence counting, signals from diffused sources are greatly minimized. Dr. Smith, who already uses two counters, could easily have incorporated the advantages of the coincidence system. Coincidence counting also diminishes the radiation

burden to the patient (half-life of ^{81}Rb is 4.7 hr, that of ^{43}K is 22.4 hr). Our report was to indicate that only 20 kg of shielding was required for coincidence counting as opposed to 550 kg necessary for focusing for the noncoincidence method.

We suggested that myocardial scanning should be done while the uptake by the heart remains constant. This poses no difficulty if one has a highly sophisticated multicrystal camera (1). This permits easy scanning within a time range of 90-270 sec, the period in which the uptake of the tracer (^{81}Rb) by the heart remains constant.

R. J. BING
SHIGEAKI IKEDA
Huntington Memorial Hospital
Pasadena, California

REFERENCE

1. BURNHAM CA, BROWNELL P: A multi-crystal positron camera. *IEEE Trans Nucl Sci* 19: 201-205, 1972

BIOMEDICAL COMPUTING TECHNOLOGY INFORMATION CENTER

The Biomedical Computing Technology Information Center (BCTIC), a new national technology resource, has been established at Oak Ridge National Laboratory. The Center will serve as a mechanism for the exchange of information and services among medical-research and clinical groups involved in computer technology. The Center is now collecting computer codes, interface designs, and other biomedical computing information for dissemination.

The Biomedical Computing Technology Information Center is sponsored jointly by the U.S. Energy Research and Development Administration, the Society of Nuclear Medicine, the FDA Bureau of Radiological Health, and the Society for Computer Medicine.

For information, and submission of technology, contact:

Biomedical Computing Technology Information Center
Oak Ridge National Laboratory
P.O. Box X
Oak Ridge, Tenn. 37830
Telephone: (615) 483-8611 Ext. 3-0293