Reply

Dr. Schneider's major objection is the use of fixed doses of radioactive iodine. He has enumerated several factors that must be taken into consideration if one is to calculate a specific thyroidal dose. In our article we enumerated some other factors, not dependent on uptake or thyroid size, that influence the incidence of hypothyroidism. There is in addition an individual variation in patient response not accountable for by any known factor. For these reasons we abandoned several years ago the type dose calculation he advocates.

Neither our hypothyroid contrasted with euthyroid, nor our blocker-treated contrasted with untreated, groups differed significantly in either radioactive iodine uptake or gland size. Specifically, the patients with the 16% and 83% uptakes were both men in their mid-30's with glands 2½ times the normal size. Neither had been treated with blockers and neither developed hypothyroidism. The next highest uptake was 81% in a man, pretreated with thyroid blockers, whose gland was three times normal size. He did not become hypothyroid.

As far as we could determine, the patients in studies that we compared with ours were similar to ours in gland sizes and uptakes. It must be remembered that we are comparing *groups* of patients treated in the same fashion. We therefore do not believe that failure to calculate specific thyroidal doses negates any of our conclusions.

ROBERT L. YOUNG
STEVEN G. DORFMAN
STANLEY E. VON HOFE
Wilford Hall USAF Medical Center
Lackland AFB, Texas

Use of Whole-Body Retention of Tc-99m Diphosphonate in the Diagnosis of Metabolic Bone Disease

The paper by Dr. Fogelman et al. (*1*) in this journal's March issue presents much-needed data regarding differing backgrounds, bone uptake, blood levels, and whole-body retentions in various metabolic diseases of bone. We have recent kinetic results indicating that bone retention of Tc-99m-HEDP after the first few hours (following the washout of exchangeable or reversibly bound activity) is proportional to the integral of the blood or plasma activity (*2*). It occurs to us that Dr. Fogelman's excellent data could be more meaningfully expressed in terms of liters of plasma cleared of the agent by the skeleton per hour—a quantitative expression of the total ability of the skeleton to concentrate the bone agent, independent of renal excretion. We have graphically integrated Dr. Fogelman's blood curves over 24 hours and divided them into his average 24-hr retention values to yield the suggested clearance values (see Table 1). This procedure not only normalizes the data for the influence of differing renal excretion rates, but also gives a direct measure of a metabolic parameter of the skeleton. We are still not completely clear as to the mechanism of irreversible fixation of the agent in bone, but presume it is related to the deposition of new bone, as well as to other factors. It is assumed in our calculations that at 24 hours the soft-tissue retention contributes only negligibly to the whole-body retention.

JAMES S. ARNOLD
NANDA KHEDKAR
W. EARL BARNES
Veterans Administration Hospital
Hines, Illinois

REFERENCES

1. FOGELMAN I, BESSENT RG, TURNER JG, et al: The use of whole-body retention of Tc-99m diphosphonate in the diagnosis of metabolic bone disease. *J Nucl Med* 19: 270–275, 1978

2. ARNOLD JS, BARNES WE, KHEDKAR N, et al: Computerized kinetic analysis of two 99m-Tc-Sn-diphosphonates demonstrating different binding characteristics. *J Nucl Med* 19: 740, 1978 (abst)

Reply

Further to Dr. Arnold's interesting treatment of our data on 24-hr whole-body retention (WBR) and plasma concentration of Tc-99m HEDP, we have carried out similar calculations of skeletal clearance for each of 48 patients with metabolic disease and 13 control subjects. (We have availed ourselves of some results obtained since our paper was submitted.) We derived the area under the plasma activity-time curve for each subject by fitting a double exponential to the data points by an iterative least-squares procedure. The skeletal plasma clearance of Tc-99m HEDP was obtained directly from the fitted parameters of the plasma curve and the 24-hr WBR. Our results are seen in Table 1. Using the Wilcoxon rank-sum test, the control group was found to be significantly different from the Paget's, renal osteodystrophy, and osteomalacia groups ($p < 0.001$). There was no significant difference between the con-

TABLE 1

Disease	% dose retained at 24 hr	Integral of plasma curve 0–24 hr % dose-hr/liter	Plasma clearance ml/hr
Normal	19.2	29.8	644
Osteoporosis	21.2	40.6	500
Hyperparathyroidism	50.7	54.0	939
Osteomalacia	40.7	33.3	1222
Renal osteodystrophy	88.6	48.4	1831
Paget's disease	56.9	25.2	2258

TABLE 1. SKELETAL PLASMA CLEARANCE OF Tc-99m HEDP

Group	Number	Plasma clearance ml/hr Mean ± s.d.	Absolute range
Normal	13	684 ± 169	296– 948
Osteoporosis	9	687 ± 229	459–1150
Primary hyperparathyroidism	8	946 ± 302	534–1429
Osteomalacia	8	1836 ± 844	995–3593
Renal osteodystrophy	11	2229 ± 1207	1099–5475
Paget's disease	12	2233 ± 897	885–3904