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Little Rock, Arkansas

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Dear Dr. Panos:

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It was gratifying to learn that you intend to study body water and fat in infants. Interest in this subject is widespread, but reliable data are almost non-existent.

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The sensitivity of the standard methods for assaying tritium in body fluids sets a lower limit on the quantity of tritium that must be given to a subject to measure total body water. In general, an accurate assay requires about 1.4 microcuries of tritium per kgm. of body weight. Concentrations smaller than this can be used, but the cost in time, effort, and reliability become exorbitant.

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This quantity of tritium will produce a whole-body radiation dose rate of about 0.021 millirad per hour shortly after administration. If the half time for water turnover in the infant is about five days, the tritium will be eliminated exponentially with a half time of five days. The accumulated radiation dose, therefore, will be about 3.6 millirad, which is roughly the equivalent of 0.004 roentgens of whole-body x-rays. For comparison, you may recall that the radiation dose from cosmic radiation and natural sources is about 0.15 roentgen per year.

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We have not conducted studies with tritium on children, and we are unlikely to do so because of University regulations. Although the radiation dose delivered in the course of a single determination of body water with tritium is about 1/40 of the annual exposure from natural radiations, some authorities would doubtless consider the use of tritium in infants inadvisable.

For many years we assayed tritium in body fluids with ionization chambers. Chambers with volumes of about 500 ml. were filled with hydrogen generated in vacuo from the fluid sample with lithium-aluminum hydride. The ionization current

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was measured and recorded with a vibrating-reed electrometer. The equipment for this method costs about \$3500.

- Liquid scintillation counting with one of the modern coincidence scintillation counters is far more rapid, it is less demanding on time and technical skill, and, I believe, more reliable. The apparatus costs \$6000 to \$8000, depending upon its characteristics, and perhaps another thousand dollars would be invested in glassware and special chemicals. When the higher cost of equipment, compared to that of the ionization chamber, is not the deciding factor, this is the method of choice.

Deuterium-labeled water has also been used for measuring T. B. W. In the hands of a few experts, particularly I. S. Edelman, deuterium gives reliable results. Some of us consider the assay of deuterium to be extremely difficult although Edelman maintains it is not.

If you decide to use tritium-labeled water, we can, if you wish, send you our procedures for both the ionization chamber and scintillation counter. For a procedure to assay deuterium, I would suggest writing to Dr. I. S. Edelman at the Medical School, University of California, San Francisco, California.

I look forward with great interest to your studies on infants.

Sincerely yours,

William Siri

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