

## BIOMEDICAL RESEARCH

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### INTRODUCTION

Continued emphasis has been placed on studies of alkaline-earth metabolism in man, with special attention given to comparative calcium-strontium behavior. The pattern of investigation has developed from intensive animal studies—designed to show the role of individual physiological processes—to more limited studies with patients that help in extrapolation of animal data to man. This information has already proved useful in evaluation of possible health hazards from contamination of the biosphere with strontium-90; but from the long-range viewpoint, this knowledge will serve as a basis for studies of the mechanism of induction of bone tumors and possible diagnostic and therapeutic application of bone-seeking radioisotopes.

Increasing amounts of time and effort have been devoted to training and educational duties, some of the more important of which have been (a) responsibility for biological aspects of Special Training Division's basic radioisotope techniques course; (b) responsibility for veterinary radiological health courses; (c) development of biology kits for high-school teachers; (d) preparation of report on "The Biological Effects of Atomic Radiation" for the National Academy of Sciences; (e) supervision of foreign scientists and research participants; and (f) editorship of a reference work entitled "Mineral Metabolism—An Advanced Treatise," to be published by Academic Press.

Plans for extension and development of research have been worked out along the lines of (a) tissue dosimetry; (b) whole-body neutron irradiation of animals; (c) controlled-environment facilities; and (d) effects of long-term exposure of animals to bone-seeking radioisotopes in the diet.

### METABOLISM OF STRONTIUM-85 IN HUMAN BEINGS

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The rationale for use of strontium-85 in tracer studies with patients, and preliminary results of single-dosage experiments, were described in the ORINS Midyear Report for the period ending December 31, 1955 (ORINS-13). Attention has now been turned to the important problem of comparative behavior of calcium and strontium in man under conditions of daily ingestion of radiostrontium in milk. Previous studies in this laboratory have shown that milk increases the absorption of both calcium and strontium, and also decreases the discrimination against strontium as compared to calcium.

Three patients have been studied so far: a 72-year-old woman with cervical carcinoma; a 37-year-old woman with ovarian tumor; and a 20-year-old man with leukemia. The procedure was to give a glass of milk containing tracer levels of cal-

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cium-45 and strontium-85 with each meal for 10 to 15 days. All excretions and periodic blood samples were collected for radioassay. The data are incomplete as yet, but it appears that the strontium-85 was retained in the body about one-half as effectively as the calcium-45.

#### ABSORPTION OF CALCIUM AND STRONTIUM FROM MILK AND NONMILK DIETS

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Previous experience had indicated that, in some animal species, absorption of calcium is noticeably increased by the presence of milk in the diet. These studies were undertaken to see whether the same effect occurred in man.

The work was done with four chronically ill patients having malignant neoplasms; a milk and a nonmilk study was made on each patient. No milk or milk products were allowed for 24 hours before the administration of the radioisotope. Normal meal schedules were maintained up to and including the last meal at 6:00 P.M. of the day preceding the experiment. The strontium-85 plus the test substance (milk or  $\text{CaCl}_2$ ) was given at 7:00 A.M. the next morning. Each subject received one pint of milk containing the  $\text{Sr}^{85}\text{Cl}_2$  or capsules of  $\text{CaCl}_2$  solution containing the  $\text{Sr}^{85}\text{Cl}_2$ . The total calcium supplied was 0.5 g; no food was allowed for three hours after dosing, and milk or milk products were excluded for another 24 hours.

Urinary and fecal collections were made for four to eight days, during which time the major part, if not all, of the unabsorbed strontium-85 had been eliminated as shown by the low fecal levels. Before the second test, the excreta were assayed to ascertain that the levels were not high enough to interfere with the subsequent measurements.

Three of the four patients absorbed an average of 34 per cent ingested strontium-85 from  $\text{CaCl}_2$ , as compared with 82 per cent from milk. In all patients there was a marked reduction in the urinary excretion of the strontium-85 when given in milk.

Rats and cattle exhibited the same effect, whereas there was no increased absorption from milk in the rabbit or chick.

#### FACTORS INFLUENCING THE COMPARATIVE METABOLISM OF CALCIUM AND STRONTIUM

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Effect of age: The pattern of calcium metabolism changes as the animal grows and there occurs (1) a decreased ability to absorb calcium from the gut; (2) a decreased retention of calcium; and (3) an increased endogenous loss of

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