

CROCKER LABORATORY
BERKELEY, CALIFORNIA

403904

April 6, 1954

Pg. 1

134

US DOE ARCHIVES	
326 U.S. ATOMIC ENERGY COMMISSION	
████████████████████	
RG	<u>DCS Historian (DBM)</u>
Collection	<u>1133</u>
Box	<u>3365</u>
Folder	<u>3</u>

Dr. Charles L. Dunham
 Chief, Medical Branch
 Division of Biology and Medicine
 United States Atomic Energy Commission
 Washington 25, D.C.

Dear Chuck:

Please find enclosed the available data from the University of California Hospital which was compiled by members of Dr. Stone's staff who incidentally are quite unaware of the classified nature of this material to the best of my knowledge. I discussed this matter with Dr. Stone and told him that it should not be discussed with anyone in the Division of Radiology with the exception of the two of us.

You will note that there has been a review of the overall situation together with rather fairly detailed accounts obtained from eight patients. The picture is not too clear since a number of patients received stable strontium and several others received some amounts of radio-strontium. In addition, in some instances P³² was given which certainly confuses the issue. However, Brunn, Erickson and Reid received quite substantial amounts of strontium⁸⁹. Consideration must be given that this radioisotope was cyclotron produced, has a half-life of 53 days and decays by emitting beta-particles with a maximum energy of 1.5 Mev. Another point that should not be ignored is the fact that at the time these studies were done there was considerable ambiguity as to the size and value of the microcurie. Extrapolating from my own experience to the present I estimate that these patients got from 20 to 50 per cent more radiation than appear on the charts.

I have discussed the situation with Dr. John Lawrence but to date I have not received any information that would be of value to you concerning those patients treated at Donner Laboratory. I gather that a number of these received both P³² and Sr⁸⁹ which would confuse the picture. As soon as I get any additional data referring to strontium in humans I will let you know as soon as possible.

Our own experimental program is progressing very nicely using both rats and monkeys. The technical details are being well worked out and we should have some data for you within the next month or six weeks. If you should find someone who would be in your opinion both competent and the type of person who would fit in with our small organization, another pair of hands would be most welcome.

Sincerely yours,

Joseph G. Hamilton, M.D.

OPENNET ENTRY
Authorized for Public Release
By <u>BJR FG</u> Date: <u>7/11/75</u>
Entered in OpenNet
By _____ Date: _____
Not Authorized for Public Release
By _____ Date: _____

WITH ATTACHMENTS/ENCL.

DEPARTMENT OF ENERGY DECLASSIFICATION REVIEW
SINGLE REVIEW AUTHORIZED BY:
<u>At S.W. 196</u> <u>11/2/84</u>
REVIEWER (ADD): <u>ML Ko</u>
NAME: <u>12/17/84</u>
DATE: _____
1. DETERMINATION (CIRCLE NUMBER(S))
2. CLASSIFICATION RETAINED TO:
3. CLASSIFICATION CHANGED TO:
4. CONTAINS FOI/DOE CLASSIFIED INFO
5. COORDINATE WITH:
6. CLASSIFICATION CANCELLED
7. CLASSIFIED INFO BRACKETED
7. OTHER (SPECIFY):

Cy. 1/A, 2/A, 3/A - Dr. Dunham
 Cy. 4/A - (File JGH).

~~████████████████████~~
 DOE ARCHIVES

Experience with Strontium Isotopes

The use of radioactive strontium (Sr^{89}) in the treatment of patients with metastatic carcinoma to bone and in osteogenic sarcoma was initiated in 1940 by Charles Pecher (1). The rationale, based on experimental animal studies, for the use of Sr^{89} was:

1. The easy production and availability of Sr^{89} as compared with that of Ca^{45} .
2. Strontium given in small amounts is handled similarly to calcium by the body. Strontium in concentrations of 20 mg/cc given i.v. is nontoxic.
3. Strontium when injected intravenously concentrates rapidly in the skeleton. After 24 hours the radioactivity per gram wet weight was approximately 100 times lower in the soft tissues than in the bones.
4. The highest concentration of Sr^{89} occurred in the bony tissues in regions of new bone formation such as epiphyseal line, or neoplastic osteoplasia.
5. Because of the rapid uptake in the skeleton, particularly in osteoplastic lesions, and because of the short path of strontium beta rays in the tissues, the radiation dose in the bone and bone lesions is high as compared with that of soft tissues. Pecher realized the limiting factor in Sr^{89} treatment, namely, the unavoidable effect on the bone marrow.

Pecher's experimental findings were confirmed by Treadwell (Mrs. Anne de G. Low-Beer), et al, (2), who investigated uptake of radiostrontium by bone tumors in six patients prior to biopsy or amputation.

The patients treated by Pecher received total doses of one to six millicuries of Sr^{89} . At autopsy these doses were found to be sub-therapeutic in effect. In terms of roentgen equivalents, it was estimated from the concentration of radiostrontium detected in the tissues that 200 r to 600 r is delivered to the bony tissue when 1 mc Sr^{89} is administered i.v. to an adult. In later studies doses as high as 10 mc Sr^{89} were administered without ill effects after six months. One patient, a physician, received 8 mc Sr^{89} in four months. The bone pain disappeared almost completely. Serum phosphatase activity dropped from 42 to 6 Bodansky units in six months.

Pecher noticed irritation of the skin and itching in some of the animals who received strontium. Low-Beer and Low-Beer subsequently investigated the concentration of Sr^{89} in the skin, hair, and sweat, using horses as experimental animals. They found high concentration in hair and sweat. This study was partly influenced by the experience with a strontium preparation called Strontiuran (Ciba or Shering), which was used in Europe in the 1920's and 1930's for skin diseases.

At the UC Hospital, Low-Beer and Sears (unpublished) studied eight patients with bone atrophy in 1943 and 1944, with Sr^{89} given in doses of 200 to 500 microcuries. Several more patients with disturbance of bone metabolism were studied by Low-Beer, giving small test or tracer doses. No follow-up is available on these patients.

In 1941, at the suggestion of R. S. Stone, a group of patients with bone metastases from carcinoma of the breast, prostate, etc., were given strontium lactate 20 mgr/cc in 10 cc doses usually twice a week for varying lengths of time. This was based on the inquiry whether the pain relieving effect is due to the radiation or whether it is due to the chemical strontium.

At the UC Hospital, in the period from 1941 to 1944, eight patients received strontium lactate; five received radioactive strontium (carrier 20 mg/cc Sr⁸⁸); and three patients received nonradioactive strontium lactate (20 mg/cc). Table I gives details concerning these patients.

References

1. Pecher, C. Biological Investigations with Radioactive Calcium and Strontium: Preliminary Report on the Use of Radioactive Strontium in the Treatment of Metastatic Bone Cancer. UC Publications in Pharmacology Vol. 2 (No.11): 117-170, 1942.
2. Pecher, C., Pecher, J. Radio-Calcium and Radio-Strontium Metabolism in Pregnant Mice. Proceedings of Society for Experimental Biology and Medicine 46: 91-94, 1941.
3. Treadwell, Anne de G., Low-Beer, B.V.A., Friedell, H. L., and Lawrence, J.H. Metabolic Studies on Neoplasm of Bone with the Aid of Radioactive Strontium. Amer. Journ. of the Medical Sciences Vol. 204 (No. 4): 521-530, October 1942.