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Comparative Deposition of Zr95 in a Reticulo Endothelial Tumor to Normal Tissue in a Human Patient

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COMPARATIVE DEPOSITION OF  $zr^{95}$  in a reticulo endothelial tumor to normal tissues in a human patient

#### by

B. V. Low-Beer, M.D., K. G. Scott, Ph.D. Joseph G. Hamilton, M.D., R. S. Stone, M.D.

March 15, 1948

Berkeley, California

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Monsanto Chemical Company, Davton	47
National Bureau of Standards	48
Patent Advisor	49
Library Branch (for NEPA). Oak Ridge	50
Library Branch. Oak Ridge	51-65
University of Rochester	66-67
Declassification Procedure	68-77
J. G. Hemilton	78-82
J. H. Lawrence	83-84
R. L. Dobson	85
N. Garden	86
R. S. Stone	87
Chemistry Department	88
University of California, Radiation Laboratory	89-95

Total

95

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-3-

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#### ABSTRACT

A test dose of Zr<sup>95</sup> was given to a female patient which had a metastatic reticulo endothelial tumor at the distal portion of the left femur. A comparison of the deposition of Zr<sup>95</sup> showed greater uptake 24 hours after administration than any of the normal tissues investigated.

COMPARATIVE DEPOSITION OF  $2r^{95}$  in a reticulo endothelial tumor to normal tissues in a human patient

By B. V. Low-Beer, M.D., K. G. Scott, Ph.D., Joseph G. Hamilton, M.D., and R. S. Stone, M.D. March 15, 1948

For eventual publication.

Contract No. W-7405-eng-48

University of California Radiation Laboratory Berkeley, California

# COMPARATIVE DEPOSITION OF Zr<sup>95</sup> IN A RETICULO ENDOTHELIAL TUMOR TO NORMAL TISSUES IN A HUMAN PATIENT

by

B. V. Low-Beer, M.D., K. G. Scott, Ph.D. Joseph G. Hamilton, M.D., R. S. Stone, M.D.

Recent studies have demonstrated that radioactive Zr<sup>95</sup> is deposited in the reticulo endothelial system of the rat (1). This radioactive isotope of zirconium is available in large quantities owing to the fact that it is produced by the fission of uranium in the pile. In decaying to Cb<sup>95</sup> it emits beta particles which have a maximum energy of 0.4 Mev rays. Owing to these decay characteristics the major portion of the ionizing radiation is expended close to the area of Zr<sup>95</sup> deposition. The gamma rays which are emitted allow precise investigation of deep regions of deposition in the body by external measurement using such a device as a Geiger Muller counter.

On January 5, 1948, a 55 year old female patient with a retioulo endothelial tumor, which arose apparently in the spleen and later metastasized to the liver and the distal epiphysis of the left femur, was given a test dose of  $Zr^{95}$ . This was administered as an isotonic saline solution intravenously 24 hours prior to the mid-thigh amputation of the left leg.

The amount of  $Zr^{95}$  given was 1.76 millicuries. Owing to the fact that the liver is the major site of deposition, the size of the test dose was limited to a safe radiation level for that organ, assuming 100% retention of  $Zr^{95}$ . This amount of radioactivity would give the liver less than 100 r over a period of two weeks. Its subsequent excretion by the

-5-

liver and the relatively short half-life of 65 days precluded any risk to the patient with respect to radiation damage. Samples of the tumor as well as normal tissues were obtained from the limb for radioactive assay. The distribution of  $Zr^{95}$  in these tissues is given in Table I as percent of the administered tracer dose per gram of tissue.

#### TABLE I

Percent of Tracer Dose Per Gram Wet Weight\*

Tissue .0005 Tumor ,0003 Femur Tibia .0002 Marrow from femur (yellow) .00006 Marrow from tibia (yellow) ,00001 Muscle (gastronemius) .00001 Fat .00001 Blood .0003 Skin .00003

An examination of Table I demonstrates the relatively greater uptake of tumor compared to the normal tissues of the body which were available for assay. Since the probable volume of all of the metastatic tumor growths could not be determined, it was impossible in this case to determine what percent of the total activity was taken up by tumor or if the concentration of  $2r^{95}$  in tumor was dependent upon its anatomical location.

\* The sensitivity of the measuring instrument was such that the determination had an error of less than + - 6%.

This work was done in the Divisions of Medicine and Radiology, University of California, San Francisco, and Crocker Radiation Laboratory, Division of Medical Physics, University of California, Berkeley, under contract W-7405-eng-48AI with the U. S. Atomic Energy Commission.

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-7-

# FIGURE I

# RADIOAUTOGRAPH 140 HOUR EXPOSURE OF TUMOR SECTION SHOWN IN FIG. III.



### FIGURE II

# RADIOAUTOGRAPH 216 HOUR EXPOSURE OF TUMOR SECTION SHOWN IN FIGURE III.



# FIGURE III

SECTION THROUGH TUMOR AND DISTAL PORTION OF FEMUR. PREPARED BY CUTTING THROUGH PORTION OF FROZEN LIMB.



### FIGURE IV

## PHOTOMICROGRAPH OF TUMOR TISSUE SHOWN GROSSLY IN FIGURE III



5



