

LIBRARY REFERENCE COPY
ON LOAN

ANL-4531

RETURN PROMPTLY TO
REPORT SECTION 203-CE125

702267

FOLDER

BOX No

COLLECTION

REPOSITORY

ANL-4531

Argonne National Laboratory

QUARTERLY REPORT

AUGUST, SEPTEMBER, OCTOBER 1950

DIVISION OF BIOLOGICAL
AND MEDICAL RESEARCH

REPOSITORY Argonne Lab
COLLECTION _____
BOX No _____
FOLDER _____

LIBRARY REFERENCE COPY
ON LOAN

RETURN PROMPTLY TO
REPORT SECTION 203-CE125

0016668

PARTIAL DOCUMENT

ANL-4531
Health and Biology

ARGONNE NATIONAL LABORATORY
P. O. Box 5207
Chicago 80, Illinois

DIVISION OF BIOLOGICAL AND MEDICAL RESEARCH
QUARTERLY REPORT, AUGUST, SEPTEMBER, OCTOBER, 1950

Editor
Austin M. Brues, Director, Division of Biological and
Medical Research

Operated by the University of Chicago
under
Contract W-31-109-eng-38

0016669

<u>Distribution</u>	<u>No. of Copies</u>
Argonne National Laboratory	76
Armed Forces Special Weapons Project	1
Atomic Energy Commission, Washington	3
Battelle Memorial Institute	1
Brush Beryllium Company	1
Brookhaven National Laboratory	4
Bureau of Medicine and Surgery	1
Carbide and Carbon Chemicals Division (K-25 Plant)	4
Carbide and Carbon Chemicals Division (Y-12 Area)	4
Cleveland Area Office	1
Columbia University (J. R. Dunning)	1
Columbia University (G. Failla)	1
E. I. du Pont de Nemours and Company	5
General Electric, Richland	6
Idaho Operations Office	6
Iowa State College	2
Kellex Corporation	1
Kirtland Air Force Base	1
Knolls Atomic Power Laboratory	2
Los Alamos Scientific Laboratory	3
Mallinckrodt Chemical Works	1
Massachusetts Institute of Technology (A. R. Kaufmann)	1
Mound Laboratory	3
National Advisory Committee for Aeronautics	1
National Bureau of Standards (R. D. Huntoon)	1
Naval Medical Research Institute	1
Naval Radiological Defense Laboratory	2
New Brunswick Laboratory	1
New York Operations Office	3
North American Aviation, Inc.	1
Oak Ridge National Laboratory (X-10 Site)	10
Patent Branch, Washington	1
RAND Corporation	1
Sandia Corporation	1
Santa Fe Operations Office	1
Savannah River Operations Office	1
Sylvania Electric Products, Inc.	1
Technical Information Service, Oak Ridge	75
USAF, NEPA Office	2
U. S. Geological Survey (T. B. Nolan)	1
U. S. Public Health Service	2
University of California at Los Angeles	1
University of California Radiation Laboratory	6
University of Rochester	2
University of Washington	1
Western Reserve University	4
Westinghouse Electric Corporation	2

0016670

<u>Supplementary Distribution</u>	<u>No. of Copies</u>
Dr. R. Antonelli	1
Armed Forces Institute of Pathology	1
Army Medical Library, Director	1
Atomic Energy Project, Chalk River	4
Chief of Naval Research	1
Dr. B. Harris	1
Harshaw Chemical Corporation	1
Isotopes Division (Mr. McCormick)	1
Library of Congress, Acquisition Department (J. W. Cormn)	2
Medical Research and Development Board	1
National Bureau of Standards (Library)	1
National Institute of Health	1
National Research Council, Ottawa	1
Naval Research Laboratory	1
Nevis Cyclotron Laboratories	1
Nucleonics	1
Oak Ridge Institute of Nuclear Studies	2
United Kingdom Scientific Mission (M. Greenhill)	10
USAF, Air Surgeon (Col. A. P. Gagge)	1
USAF, Director of Research and Development (Major Fred W. Bruner)	1
USAF, Wright-Patterson Air Force Base (CADO)	5
U. S. Army, Army Medical Service Graduate School (Col. W. S. Stone)	1
U. S. Army, Atomic Energy Branch (Lt. Col. A. W. Betts)	1
U. S. Army, Director of Operations Research (Dr. Ellis Johnson)	1
U. S. Army, Office of the Chief Signal Officer (Curtis T. Clayton thru Major George C. Hunt)	2
U. S. Army, Technical Command (Col. J. H. Rothschild, Attn: Technical Library)	3
University of Chicago Toxicity Laboratory	1
UT-AEC Agricultural Research Program (Charles S. Hobbs)	1
Total	300

0016671

TABLE OF CONTENTS

	Page
Administration.	7
Editorial.	8
Chronic External Irradiation	14
Progress Report: Effect of Irradiation on a Transplantable Mouse Lymphosarcoma	14
Progress Report: Quantitative Histologic Studies of the Testes of Mice Exposed to 50 r X rays	17
Progress Report: Effects of Spleen Protection During X irradiation	20
Further Observations on the Effect of Total-body Irradiation upon the Eyes of Mice	21
Final Report: The Blood Picture of Acutely Exposed Hybrid Guinea Pigs.	27
Preliminary Report: Mass Spectrometer Analysis of the Respired Air of Rats.	40
Hematology	47
Preliminary Report: Spleen Shielding and Allied Studies. . .	47
Physiology	58
Progress Report: Comparison of Late Effects in Cysteine and Control Irradiated Rats	58
Histology and Histopathology	64
Progress Report: Effects of Different Fixatives on Connec- tive Tissue as Observed in the Electron Microscope.	64
Radium Toxicity	72
Summary of Attempts to Remove Radium from One Patient .	72
Radium Project: Clinical Aspects.	76

TABLE OF CONTENTS

	Page	
Radium Toxicity (Cont'd.)	77	Bioch
Radium Toxicity.	77	
Determination of Radon in Expired Air	78	
Experimental Pathology.	80	Radic
Progress of the Polonium Mouse Experiment. II. Analysis at 500 days	80	
Special Problems	93	Radi
Retention of C ¹⁴ Administered as Bicarbonate to Adult and Embryonic Mice.	93	
Population Growth of <u>Chilomonas paramecium</u> after X irradiation.	107	
Progress Report: The Growth of Mouse Tumor Transplants in X-irradiated and Nonirradiated Rats	111	Rad
Progress Report: Protective Effect of Methylene Blue against Lethal Doses of Total-body X irradiation of Mice	116	
Progress Report: Toxicity of Tritium Oxide Administered Continuously to Rats	120	
Progress Report: β -irradiation Effects from Diffuse and Point Sources of Sr ⁹⁰	123	Mi
Progress Report: Effect of X irradiation on the Inorganic Phosphorus: Total Acid-Soluble Phosphorus Ratio of Diapause Grasshopper Embryos	126	
Preliminary Report: Daily Dose Lethality Data for Rabbits.	128	
Progress Report: Renal Function in Irradiated Chicks	136	
Progress Report: Protection of Cells from Radiation Injury by Anaerobiosis	138	

TABLE OF CONTENTS

Page		Page
77	Biochemistry	143
77	The Effect of X irradiation on the Absorption Spectrum of Adenosine Triphosphate, Pyridine Nucleotide, and Nucleic Acids	143
78		
80	Radiochemistry	153
80	Determination of Na and P in Bone by Neutron Activation Analysis	153
93	Radiobiochemistry	156
93	Progress Report: Radiobiochemistry	156
93	The Distribution of Tritium in Body Fluids	157
107	Preliminary Report: Protection against Experimental Beryllium Poisoning by Aurin Tricarboxylic Acid	158
111	Radiological Physics Research	163
116	Progress Report: Ionization in Air from Beta-ray Point Sources	163
120	Absolute Measurements of Beta-ray Activity	168
123	Progress Report: Concentration Measurements of Freon by an Ionization Method	169
126	Miscellaneous	177
126	Progress Report: The Effects of X irradiation upon Fighting Behavior in Male Mice	177
28	Preliminary Report: Artificial Insemination of Mice with Sperm Cells X-irradiated <u>In Vitro</u>	179
36	Uranium Toxicity in Mice. I. Experimental Design and Results at 30 Days	183
8		

0016674

TABLE OF CONTENTS

Admini

	Page
Miscellaneous (Cont'd.)	191
Progress Report: The Retention and Distribution of U ²³³ in Mice.	191
An Interrelationship between Time-Retention Curves in Short Vs. Prolonged Isotope Exposures	192
Index	193

assoc
He re
Chica
crops

Dr. C
Dr. A
in 19
Tech

who
work

Expe
ing
to th

on
to th

fess
ple
rel

Administration

Page

Austin M. Brues, Director
 Hermann Lisco, Associate
 Director
 Leonidas D. Marinelli, Associate
 Director
 E. Lawrence Powers, Associate
 Director
 Rosson L. Cardwell, Assistant
 to the Director

191

191

192

193

PERSONNEL CHANGES

Dr. John Skok has joined the Radiobiology Experiment Station as an associate scientist and will use radiotracers to investigate plant nutrition. He received his Ph.D. degree in plant physiology from the University of Chicago in 1941 and from 1942 to 1950 was assistant professor of vegetable crops at the University of Illinois.

A recently appointed associate scientist who will work with Dr. Gordon in the Phytoradiobiology Group is Dr. Daniel E. Atkinson. Dr. Atkinson received his Ph.D. in plant chemistry from Iowa State College in 1949 and spent a year as a research fellow at California Institute of Technology.

Miss Phyllis E. Johnson, a new appointee to the Biochemistry Group who received her M.A. degree from Mount Holyoke College in 1950, will work with Dr. Barron on the action of radiation on enzyme systems.

Dr. Cornelius Pettinga has completed his work with the Radiobiology Experiment Station, which involved biosynthesizing, extracting, and purifying carbon¹⁴-labeled morphine from opium poppy plants. He has returned to the Eli Lilly Company.

After completing one year investigating the effects of temperature on X-ray inactivation of bacteriophage, Dr. Cletus S. Bachofer has returned to the Department of Biology of the University of Notre Dame.

Dr. David Mark Morris has accepted a position as assistant professor of biology at North Texas State College in Denton, Texas after completing an AEC postdoctoral fellowship studying iodine metabolism in relation to pituitary function.

0016676

Robert J. Hasterlik
Leonidas D. Marinelli
Austin M. Brues
William B. Looney
William P. Norris
Andrew H. Stehney
Charles E. Miller

SUMMARY OF ATTEMPTS TO REMOVE RADIUM
FROM ONE PATIENT

by
W. P. Norris and A. M. Brues

In an earlier report⁽¹⁾ we described preliminary observations on a 57-year-old chemist who had worked in a radium refinery for 35 years. Radium content from breath radon samples was estimated as $2 \mu\text{c}$ on the basis of two observations of 2.08 and $1.80 \mu\mu\text{c}$ per liter. The patient was hospitalized and was treated by the "deleading" technique described by Aub, Evans, Gallagher, and Tibbetts⁽²⁾, as well as with intravenous sodium citrate, intramuscular bismuth salicylate, and aluminum hydroxide by mouth.

Table 6 shows the weights and calcium and radium contents of bone and dental specimens which were obtained. The fibular specimen was from an area of aseptic necrosis, and it is seen that the radium content of this specimen is lower in relation to calcium than on the button of sternum removed for bone marrow biopsy. Assuming a total radium content of $2 \mu\text{g}$ and a total calcium content of 1 kg, the average body ratio would be $\text{Ca}:\text{Ra} = 2 \times 10^{-9}$. A summary of analyses of excreta from this patient while in the hospital is given in Table 7. $\text{Ra}:\text{Ca}$ ratios are calculated for periods of 3 to 5 days and indicate an increase in the $\text{Ra}:\text{Ca}$ ratio of urine, which always remains much lower than the fecal ratio. Examination of the data of Aub and colleagues⁽²⁾ shows a similar relationship in the patients in that study.

REPORT

C

F

PL

Table 6

WEIGHTS AND CALCIUM AND RADIUM CONTENTS OF BONE AND DENTAL SPECIMENS

Sample	Wt. sample	Mg Ca	Mg P	Curies total Ra	% of 2 μ c	Ra:Ca x 10 ⁻⁹
Sternal biopsy	0.1404	14.6	5.36	0.53 x 10 ⁻¹⁰	0.0026	3.6
Biopsy of rt. fibula	1.8912	318.0		3.66	0.018	1.1
<u>Teeth</u>						
l. lower 3	0.9643	218		11.50	0.057	1.9
l. lower 2	0.5480	163		3.89	0.019	2.4
l. lower 1	0.4885	84.8		14.4	0.072	
r. lower 1	0.4700	57		10.7	0.053	
r. lower 2	0.4680	54		5.75	0.029	

Table 7
SUMMARY OF TREATMENT AND RESULTS

Date (of July, 1946)	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	
Estimated Ca intake (g)	1.0	1.0	1.0	1.0	1.3	1.0	1.0	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.12	0.12	0.12	
Administered parathormone (units)																								
NH ₄ Cl (g)								300	300	300	500	600	600	600	600	600	600	750	800	800	800	800	800	
Blood Ca (mg %)	10.1	10.6			10.6			10.8	11.8	10.7	9.2	11.5		11.0	11.3		11.1		10.3					10.8
Blood P (mg %)	2.4	2.7			2.7			3.0	3.9	3.0	3.3	2.7		2.6	3.0		3.6		2.7					1.8
Serum alkaline phosphatase (KA units/100 cc)	2.4	1.4			2.1			1.5	1.8	1.5	1.8	1.5		1.3	1.5		1.2		2.1					3.3
Urinary N (g)					10.5	11.1	11.7	11.3	15.0	15.0		15.7	14.1		16.0									
Urinary Ca (g)					0.11	0.09	0.11	0.07	0.21	0.30	0.26	0.39		0.34	0.17	0.24	0.33	0.29	0.27	0.20	0.18	0.28	0.23	
Urinary P (g)					0.88	0.96	0.93	0.70	0.91	0.81	0.96	1.25	0.74	0.84	0.54	0.83	0.71	0.94	0.83	0.59	0.75	0.31	0.39	
Urinary creatinine (g)					1.6	1.7	1.8	1.7	1.9															
Fecal Ca (g)					0.44/day		0.81	0.53/day		0.75/day		0.9/day		0.9/day	0.75		0.41/day		1.19		0.78/day		0.81	
Fecal P					0.55/day		1.13	0.33/day		0.61/day		0.64/day		0.64/day	1.28		0.43/day		1.2					
Urinary Ba:Ca x 10 ⁻¹¹					7.4	6.1	17.3	4.65	19.8	12.6	23.2	30.6	83.4	27.4	25.2	27.8	40.4	47.3	44.5	80.4	32.8	38.4		
Fecal Ba:Ca x 10 ⁻¹¹					218/day		1040	468/day		620/day		820/day		820/day	925		198/day		520		750/day		1910	
Urinary Ba:Ca x 10 ⁻⁴					0.087				0.074						0.133						0.198			
Fecal Ba:Ca x 10 ⁻⁴					0.80				0.84						0.83						1.10			

0016679

LITERATURE CITED

1. Brues, A. M. 1946. Preliminary report on attempted removal of radium from one patient. Quarterly Report, Biology Division, Argonne National Laboratory, August to October, 1946. ed., A. M. Brues. CH-3711 (declassified). Pp. 4-6.
2. Aub, J. C., R. D. Evans, D. M. Gallagher, and D. M. Tibbetts. 1938. Effect of treatment on radium and calcium metabolism in the human body. Ann. Internal Med., 11:1443-1463.

0016680

RADIUM PROJECT: CLINICAL ASPECTS

by

W. B. Looney and R. J. Hasterlik

The past quarter has been devoted to the collection of data pertinent to the whereabouts of various patients previously injected intravenously with Ra²²⁶ during 1931 and 1932 at the Elgin State Hospital. This group comprises those patients studied and reported by Schlundt, Nerancy, and Morris⁽¹⁾ and eight independent cases.

Nineteen persons are still resident as patients in Illinois State hospitals; ten are known to be dead; eight were discharged and their present status is being determined; and the charts of two patients have not been located.

Dr. Herman Schlundt's original data sheets have been found and reviewed, and the dosages administered to 30 of the group are known. These vary from a minimum dose of 70 μ g to a maximum of 450 μ g Ra²²⁶. The dosage schedule was the same for all patients; 10 μ g were administered intravenously at weekly intervals. The γ -ray and radon breath levels are known for 18 patients at 6 months after radium administration and for 13 at 12 months.

Contemplated studies include 1) excretion rates of urinary and fecal radium as estimated by the method of Russell, Lesko, and Schubert,⁽²⁾ 2) calcium excretion on a fixed, known calcium uptake, 3) radon breath and γ -ray measurements, 4) roentgenographic studies of the skeleton, 5) hematologic and biochemical studies, and 6) complete physical evaluation of each patient.

LITERATURE CITED

1. Schlundt, H., J. T. Nerancy, and J. P. Morris. 1933. The detection and estimation of radium in living persons. IV. The retention of soluble radium salts administered intravenously. *Am. J. Roentgenol. Radium Therapy*, 30:(4)515-522.
2. Russell, E. R., R. C. Lesko, and J. Schubert. 1950. A direct method for determining radium in exposed humans. *Nucleonics*, 7:(1)60-64.

RADIUM TOXICITY

E. by
C. ~~A.~~ Miller and L. D. Marinelli

In order to assess the known fraction emanating from radium existing in the patients at Elgin State Hospital, a fairly comprehensive study has been made of apparatus most suitable to the purpose.

Geiger-Müller counters, with gold and bismuth cathodes, and a scintillation counter, making use of an NaI crystal, have been compared as to quantum efficiency and sensitivity to background ratio in the presence of 1 μc of radium at a 1-meter distance. It has been found that the scintillation counter, properly equipped with a cosmic-ray anti-coincidence shield, will provide sufficient sensitivity for the task.

The necessary circuits and equipment are being designed and constructed.