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Plutonium Studies at the
Center for Human Radiobiology (CHR)

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The manuscript stated that "Need for the above information was recognized several years ago. It was also recognized that such information could be obtained only by administering small tracer amounts of plutonium to persons with a relatively short life expectancy. The first tracer study was initiated April 10, 1945 (12). Shortly thereafter, both the Chicago and Berkeley groups initiated similar studies (13), (14)."

We also note that: "The life expectancy of the individual was carefully considered as a basis of selection of subjects for study. As a rule, the subjects chosen were past forty-five years of age and suffering from chronic disorders such that survival for ten years was highly improbable."

The data gathered together in LA-1151 were reviewed in a manuscript prepared by Patricia W. Durbin, of the Division of Biology and Medicine, Lawrence Berkeley Laboratory, for publication in the 1972 symposium volume, Radiobiology of Plutonium. In her manuscript, entitled "Plutonium in Man: A New Look at the Old Data," Durbin clearly defines the purpose of the study: "If urinalysis was to be a reliable assay for Pu, characterization of its behavior in man was essential. For this reason, 18 hospitalized persons were injected with tracer amounts of Pu in 1945 and 1946." She also indicated that case Cal-3 was "Alive and well 7/17/68, 21 yr. post injection."

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In subsequent discussions with Dr. Durbin, we learned that several other cases were still alive. In order that these cases might be studied in detail, she turned over to the Center for Human Radiobiology all of the information that she had gathered on these cases. The records were delivered to us by Dr. Durbin on a visit here on 12/13/1972.

Our records of the 12/13/1972 visit show that Dr. Durbin advised us that:

- 1) There was an immediate need for financial support of a metabolic study (to obtain blood and excreta) of three surviving cases presently living in the Rochester, N. Y., area.
- 2) Christine Waterhouse, M.D., of Strong Memorial Hospital would make arrangements and provide medical supervision for a stay in the metabolic ward. She regularly saw two of these patients in her clinic at Rochester.
- 3) Dr. Waterhouse did not want these patients upset by mention of their injection with plutonium. Dr. Stehney replied that this should be handled by the Rochester human use committee, if needed; our part would be to analyze excreta. *
- 4) Dr. Durbin had previous discussions with Dr. Wright Langham (Los Alamos) and Louis Hempelman, M.D. (Univ. of Rochester), and said she had an obligation to ensure the participation of the Los Alamos Scientific Laboratory in the radiochemical analyses.
- 5) Dr. Durbin had discussed the funding of these studies with Joseph Goldstein, M.D. (AEC-DBER). *
- 6) Dr. Durbin, with the help of George LeRoy, M.D. (Univ. of Chicago), had identified two of the three Chicago cases.

Our records show the following activities with respect to these cases:

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- 12/21/1972 Memo R. E. Rowland to H. A. Schultz (CHR). Transmits case records to CHR Records Room. Mention of plutonium is specifically prohibited outside of CHR.
- 1/3/1973 Meeting of CHR staff to discuss plutonium cases. Responsibility assigned to M. S. Littman, M.D., to work with Dr. Waterhouse; A. F. Stehney to arrange financial details.
- 1/4/1973 Letter R. E. Rowland to Christine Waterhouse, M.D. Confirms and expands on details of metabolic studies.
- 1/26/1973 R. B. Holtzman (CHR) visited Strong Memorial Hospital to arrange details of collection and shipment of metabolic samples.
- 1/28/1973 Case HP-3 was in Strong Memorial Hospital from 1/28/1973 to 2/18/1973.
- 2/1/1973 M. S. Littman, M.D. (CHR) visited Strong Memorial Hospital to see patient HP-3 and to meet Dr. Waterhouse and discuss details of examinations of patients.
- 2/8/1973 J. Rundo (CHR) visited Strong Memorial Hospital to attempt an in vivo measurement of plutonium on patient HP-3. No plutonium was detected.
- 3/7/1973 A. M. Brues, M.D. (CHR) wrote to a physician in Italy, Texas, about contacting patient Cal-3 for study at Rochester.
- 4/24/1973 A. F. Stehney wrote to M. M. Shanahan at MIT transmitting copies of CHR information on 10 dead cases with instructions to locate relatives for permission to exhume.
- 6/11/1973 Case Cal-3 was at CHR for physical examination and radio-activity measurements (none detected).

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- 6/13/1973 Case Cal-3 was at Strong Memorial Hospital 6/13/1973 to 6/26/1973.
- 6/21/1973 Case HP-6 was in Strong Memorial Hospital 6/21/1973 to 7/1/1973.
- 9/--/1973 Urine samples from HP-3 and HP-6 were measured and found to contain ^{239}Pu .
- 9/24/1973 Case HP-4 exhumed and brought to CHR. Bone definitely contains ^{239}Pu .

In the future we would like to bring case HP-8 into Strong Memorial Hospital for excreta collections. The urinary plutonium content of the three HP cases should then be published with a model showing the urinary elimination as a function of time from injection to some 10,000 days after injection.

We would like to arrange for at least one, and preferably all, of the living cases to will their bodies to the Center for Human Radiobiology. We will continue our efforts to exhume additional cases. Studies of exhumed cases and willed bodies will provide data on the organ contents at long times after acquisition of plutonium. Autoradiography of bone will provide extremely valuable insights as to the rate of burial of surface-deposited plutonium by additional layers of new bone, data much needed to extrapolate the known toxicity of plutonium in dog to man.

For reference, a summary of the injection cases, as known to us today, is attached.

R. E. Rowland
November 8, 1973

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Table 1. Basic data on transuranic injection cases (November 8, 1973)

PRIVACY ACT MATERIAL REMOVED

Case No.	Sex	Birth	Injection			Material	Cause	Death		Notes
			Disease	Date	µCi			Date	Survival	
I-1	M		Gastric carcinoma	5/14/45	5.2	²³⁸ Pu (VI) ²³⁹ Pu (VI) Nitrates	Heart disease	1/09/66	20.8 yr.	Gastrectomy and splenectomy, loan of ashes under investigation.
I-2	M		Osteogenic sarcoma	4/26/46	0.17	²³⁹ Pu (VI) Nitrate		1/06/47	8 mo.	Deceased Australia. Do not have death certificate.
I-3	M		Chondromyxosarcoma l. leg	7/18/47	0.095	²³⁸ Pu (VI) Nitrate			Living	Injected in leg which was amputated 4 days post injection. CHR exam 6/11/73 and Rochester metabolic study 6/13 - 6/26/73. Buried in Austin, Texas. No kin have been found.
I-I	M		Buccal epithelioma	4/26/45	0.40	²³⁹ Pu (VI) Citrate	Cancer of chin, lungs	10/03/45	160 days	
I-II	F		Metastatic carcinoma of breast	12/27/45	5.8	²³⁹ Pu (VI) Citrate	Metastatic carcinoma breast	1/13/46	17 days	Cremated, ashes may have been scattered.
I-III	M		Hodgkin's disease	12/27/45	~ 5	²³⁹ Pu (VI) Citrate			> 160 days	Not identified; "young adult" at injection.
-1	M		Duodenal ulcer, gastrointestinal hemorrhage	10/16/45	0.28	²³⁹ Pu (IV) Citrate	Broncho pneumonia	1/12/60	14.2 yr.	Exhumation being sought.
-2	M		Hemophilia, hypertension, heart disease	10/23/45	0.31	²³⁹ Pu (IV) Citrate	Heart disease	4/04/48	2.5 yr.	Exhumation being sought.
-3	F		Hepatitis Hypoproteinemia	11/27/45	0.30	²³⁹ Pu (IV) Citrate			Living	Recent Rochester metabolic study, 1/23 - 2/12/73.

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PRIVACY ACT MATERIAL REMOVED

c (1)	Sex	Birth	Injection				Death			Notes
			Disease	Date	µCi	Material	Cause	Date	Survival	
4	F		Cushing's Syndrome	11/27/45	0.30	²³⁹ Pu (IV) Citrate	Cushing's Syndrome	4/29/47	2.2 yr.	Exhumed 9/24/73
5	M		Amyotrophic lateral sclerosis	11/30/45	~0.3	²³⁹ Pu (IV) Citrate	Broncho pneumonia	4/29/46	5 mo.	Exhumation permission refused.
6	M		Addison's disease	2/01/46	~0.3	²³⁹ Pu (IV) Citrate			Living	Recent Rochester metabolic study, 6/21 - 7/1/73
7	F		Rheumatic heart disease	2/08/46	0.39	²³⁹ Pu (IV) Citrate	Pulmonary failure	10/27/46	8.6 mo.	Exhumation permission improbable at present.
8	F		Scleroderma and duodenal ulcer	3/09/46	0.40	²³⁹ Pu (IV) Citrate			Living	Refused study at Rochester (Feb., 1973).
9	M		Dermato-myctosis	4/03/46	0.38	²³⁹ Pu (IV) Citrate	Broncho pneumonia	7/02/47	1.3 yr.	Exhumation being sought.
10	M		Rheumatic heart disease	7/16/46	0.38	²³⁹ Pu (IV) Citrate	Status unknown			
11	M		Alcoholism, cirrhosis of liver	2/20/46	~0.4	²³⁹ Pu (IV) Citrate	Broncho pneumonia	2/26/46	6 days	No kin have been found.
12	M		Osteochondromatosis left knee	4/10/45	~0.3	²³⁹ Pu (IV) Citrate	Status unknown			Record destroyed by a fire Oak Ridge hospital.
-A	M		Osteogenic sarcoma	6/10/47	0.25	²⁴¹ Am		5/15/48	11 mo.	Buried in San Francisco

PRIVACY ACT MATERIAL REMOVED

Cal-1, 2, 3 were injected at U. of California at San Francisco hospital. Chi-I, II and almost certainly III were injected at Billings Hospital, Chicago. HIP-1 to 11 were injected at Rochester, probably Strong Memorial Hospital (10 of these cases were maintained on the SMH metabolic ward).

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PRIVACY ACT MATERIAL REMOVED

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Chi-1, II and almost certainty III were injected at Billings Hospital, Chicago.

HP-1 to -11 were injected at Rochester, probably Strong Memorial Hospital (10 of these cases were maintained on the SMH metabolic ward).

HP-12 was probably injected at Oak Ridge Hospital, Tennessee.

PRIVACY ACT MATERIAL REMOVED

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