

THE CURRENT STATUS OF THYROID DISEASE AMONG  
THE MARSHALLESE EXPOSED TO FALLOUT FROM  
THE BRAVO TEST, MARCH 1, 1954

(The following data are taken from an informal report by Dr. Conard dated 4/20/71)

The current status may be updated as follows:

- I. Young Rongelapese exposed to fallout March 1, 1954, when they were 1 to 8 years of age. (Estimated dose: 175 rads external gamma plus 600 to 1400 rem internal irradiation.)

Total - 19

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| 1. Currently normal by clinical and biochemical tests. (There may be a slight unevenness of the gland in one patient.)   | 2 (11%)  |
| 2. Currently hypothyroid with minimal nodularity. Responding satisfactorily to oral thyroid hormone therapy.   | 3 (16%)  |
| 3. Have undergone surgery in the U. S. prior to 1969 because of nodular thyroid disease; histologic diagnosis of adenomatous goiter and Huerthle cell tumor. Responding satisfactorily to oral thyroid hormone therapy with one exception: This patient shows some enlargement of the remnant of thyroid left from a partial thyroidectomy in 1964; as she has not followed her post-operative thyroid hormone regimen, there is question as to whether she should have further surgery. | 11 (58%) |
| 4. Young people operated on for thyroid disease during August 1969 and recovered. Diagnoses: Primary benign adenomatous goiter in two and papillary adenoma of serious grade malignancy in one.  | 3 (16%)  |

(None of six Ailinginae children exposed to an estimated external dose of 69 rads have shown thyroid dysfunction.)

- II. Surviving adult Rongelapese exposed to fallout. (Estimated dose: 175 rads external plus 160 rem internal irradiation.)

Total - 34 **DOE ARCHIVES**

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| 1. Papillary carcinoma removed surgically at age 41. No recurrence. Taking oral thyroid hormone therapy. | 1 |
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2. Small nodule at age 40 which disappeared under oral thyroid hormone therapy. 1
3. This patient operated on in 1969 for removal of an invasive adenoma; has recovered satisfactorily 1

(All the above in I and II who underwent surgery appear to be in good health without evidence of recurrence.)

III. Surviving adult Ailinginae people exposed to fallout. (Estimated dose: 69 rads external gamma irradiation.)

Total - 8

1. Adenomatous goiter removed at age 45; recovered and was on thyroid therapy. Died of influenza in 1968.

IV. Surviving adult Utirik people exposed to fallout. (Estimated dose: 14 rads external gamma plus 15 rem internal irradiation.)

Total - 120

1. One person developed a nodular thyroid gland and underwent surgery in 1969. As the tissue resembled a follicular adenoma in frozen section, a total thyroidectomy was performed; histologic sections confirmed the diagnosis and upgraded the degree of malignancy. She has recovered satisfactorily.
2. One person with slight enlargement of one lobe of the thyroid to be treated conservatively and observed.

One case of nodular thyroid has been found in a non-exposed Rongelap woman living on Ebeye. Thyroid surgery has been recommended for this patient at Majuro Hospital. No other instances of thyroid abnormalities have been found in the control populations living on Utirik, Majuro or Ebeye.

It appears that the exposed populations have stabilized so far as the thyroid reactions are concerned.

**DOE ARCHIVES**

## REFERENCES

The following reports concerning the Pacific Proving Grounds, the Bravo Test and the subsequent events are in the public domain. Those referenced are placed first.

The bibliography under Published Reports and Articles in Medical Journals below is not complete. Papers have been omitted which dealt with the development of techniques used in the laboratory or have reported some aspect of the study which has a limited or specific scientific interest. Also omitted are reprints of speeches made by members of the teams at various times and places. On the other hand the reluctance of editors or biomedical journals to publish bulk data has caused Dr. Conard to record summarized versions of the bulk data of a survey or group of surveys as Brookhaven National Laboratory reports. These can be used as source books and in fact have been so used by agencies such as the United Nations. Subjects of special interest to medicine and radiation biology have been developed from the data in these source books and published in the journals and proceedings referenced.

1. PROVING GROUND: An Account of the Radiobiological Studies in the Pacific, 1946-1961. N. O. Hine. Chapters 7-11. Univ. Wash. Press, Seattle, 1962. 366 pp.
2. Some effects of ionizing radiation on human beings: A report of the Marshallese and Americans accidentally exposed to radiation from fallout and a discussion of radiation injury in the human being. E. P. Cronkite, V. P. Bond, and C. L. Dunham, eds. Naval Med. Res. Inst., Naval Radiol. Defense Lab. and Brookhaven Nat. Lab., 114 p., TID 5356, 1956.
3. THE VOYAGE OF THE LUCKY DRAGON. R. E. Lapp. Harper O. Brothers, New York, 1958. 200 pp.
4. APPENDIX B IN THE EFFECTS OF NUCLEAR WEAPONS. Ed. S. Glasstone. Revised Edition. USDOD and USAEC. Supt. of Documents, U. S. Govt. Print. Off., Washington, D. C. 730 pp.

### PUBLISHED REPORTS AND ARTICLES IN MEDICAL JOURNALS

Twelve-month post-exposure survey on Marshallese exposed to fallout radiation. E. P. Cronkite, C. L. Dunham, D. Griffin, S. D. McPherson, and K. T. Woodward. Brookhaven National Laboratory Report, BNL 384 (T-71), 1955.

Physical factors and dosimetry in the Marshall Island radiation exposures. C. A. Sondhaus and V. P. Bond. Naval Radiol. Defense Lab., WT 939 (Del.), 1955.

DOE ARCHIVES

Skin lesions, epilation and nail pigmentation in Marshallese and Americans accidentally contaminated with radioactive fallout.

R. A. Conard, N. R. Shulman, D. A. Wood, C. L. Dunham, E. L. Alpen, and L. E. Browning.

Naval Medical Research Institute and Naval Radiological Defense Laboratory, NMRI Report NM 006 012. 04.82, 1955.

Response of human beings accidentally exposed to significant fallout radiation from a thermonuclear explosion.

E. P. Cronkite, V. P. Bond, R. A. Conard, N. R. Shulman, R. S. Farr, S. H. Cohn, C. L. Dunham, and L. E. Browning.

J. Am. Med. Assoc. 159: 430-434, 1955.

Medical examination of the Rongelap people six months after exposure to fallout radiation during Operation Castle.

V. P. Bond, R. A. Conard, J. S. Robertson, and E. A. Waden, Jr.

Operation Castle Addendum Report 4.1A WT-937, April, 1955.

The effects of fallout radiation on the skin.

In: THE SHORTER TERM BIOLOGICAL HAZARDS OF A FALLOUT FIELD. AEC-DOD, pp. 135-42, U. S. Government Printing Office, Washington, D. C., 1956.

Response of human beings accidentally exposed to significant fallout radiation from a thermonuclear explosion (summary).

R. A. Conard, E. P. Cronkite, V. P. Bond, N. R. Shulman, R. S. Farr, S. H. Cohn, C. L. Dunham, and L. E. Browning.

In: PROGRESS IN RADIOBIOLOGY. Eds. J. S. Mitchell, B. E. Holmes, and G. G. Smith, Oliver and Boyd, Edinborough, London, pp. 491-493, 1956.

Medical survey of the Marshallese two years after exposure to fallout radiation.

R. A. Conard, C. E. Huggins, A. Lowrey, and J. B. Richards.

BNL Report 412 (T-80), March, 1956.

J. Am. Med. Assoc. 164 (11): 1192-1197, 1957.

Radioactive contamination of certain areas in the Pacific Ocean from nuclear tests, a summary of the data from the radiological surveys and medical examination.

Ed. G. M. Dunning.

U. S. Atomic Energy Commission, pp. 45-51, August 1957.

March 1957 medical survey of Rongelap and Utirik people three years after exposure to radioactive fallout.

R. A. Conard, L. M. Meyer, J. E. Rall, A. Lowrey, S. A. Bach, B. Cannon.

E. L. Carter, M. Eicher, and H. Hechter.

BNL Report 501 (T-119), June, 1958.

DOE ARCHIVES

The determination of internally deposited radioactive isotopes in the Marshallese people by excretion analysis.

R. A. Conard.

In: FALLOUT FROM NUCLEAR WEAPONS TESTS. Hearings 86th Congr., 1st sess., May 5, 6, 7, and 9, 1959. Joint Comm. on Atomic Energy, Special Subcommittee on Radiation, Washington. U. S. Govt. Printing Off., v. 2, pp. 1332-47, 1959.

Medical survey of Rongelap people, March 1958, four years after exposure to fallout.

R. A. Conard, J. S. Robertson, L. M. Meyer, W. W. Sutow, W. Wolins, A. Lowrey, H. C. Urschel, J. M. Barton, M. Goldman, H. Hechter, M. Eicher, R. K. Carver, and D. W. Potter.

BNL Report 534 (T-135), May, 1959.

Medical status of Rongelap people five years after exposure to fallout radiation.

R. A. Conard

In: Biological and Environmental Effects of Nuclear War, hearings before the Special Subcommittee on Radiation, Joint Committee on Atomic Energy, 86th Congr., 1st sess., June 22-26, 1959, Part 1, pp. 430-2, U. S. Government Printing Office, Washington, D. C., 1959.

An intestinal parasite survey on Rongelap Atoll in the Marshall Islands.

M. Goldman and R. K. Carver.

American J. Tropical Med. and Hygiene 8 (4): 417-423, 1959.

Blood groupings in Marshallese.

L. N. Sussman, L. M. Meyer, and R. A. Conard.

Science 129 (3349): 644-645, March, 1959.

Effects of fallout radiation on a human population.

R. A. Conard, L. M. Meyer, J. S. Robertson, W. W. Sutow, W. Wolins, and H. Hechter.

Radiation Research. Supplement 1: 280-295, 1959.

Health Survey of the Trust Territory of the Pacific Islands.

Hetzel, A. M.

U. S. Armed Forces Medical Journal 10 (10): 1199-1222, 1959.

High prevalence of high-level  $\beta$ -amino-isobutyric acid excretors in Micronesians.

B. S. Blumberg, and S. M. Gartler.

Nature (London) 184 (4704): 1990-1992, 1959.

DOE ARCHIVES

Medical survey of Marshallese people five years after exposure to fallout radiation.

R. A. Conard.

Presented at the symposium on the Immediate and Low Level Effects of Ionizing Radiations, Venice, June, 1959. Special supplement (Suppl. 1) to the Int. J. Radiation Biology, Taylor and Francis, Ltd., London, pp. 269-81, 1960.

Radioisotopes and environmental circumstances: The internal radioactive contamination of a Pacific Island Community exposed to local fallout.

S. H. Cohn, J. S. Robertson, and R. A. Conard.

In: *RADIOISOTOPES IN THE BIOSPHERE*. Chapter XXI. Eds. R. S. Caldecott and L. A. Snyder, University of Minnesota Center for Continuation Study of the General Extension Division, pp. 306-36, 1960.

Medical status of Marshall Islanders in 1959, five years after exposure to fallout radiation.

R. A. Conard, L. M. Meyer, W. W. Sutow, B. S. Blumberg, A. Lowrey, S. H. Cohn, W. H. Lewis, J. W. Hollingsworth, H. W. Lyon.

*Nuclear-Medizin* 1: 314-330, 1960.

Medical survey of Rongelap people five and six years after exposure to fallout.

R. A. Conard, H. E. MacDonald, A. Lowrey, L. M. Meyer, S. Cohn, W. W. Sutow, B. S. Blumberg, J. W. Hollingsworth, H. W. Lyon, W. H. Lewis, Jr., A. A. Jaffe, M. Eicher, D. Plotter, I. Lanwi, E. Rilon, J. Iaman, and J. Helkena.

BNL Report 609 (T-179), September, 1960.

Addendum: A note on the vegetation of the northern islets of Rongelap Atoll, Marshall Islands, March, 1959.

B. S. Blumberg, and R. A. Conard.

*Ibid.*, pp. 85-86.

The biological hazards of a fallout field.

R. A. Conard.

In: *RADIOACTIVITY IN MAN*. Ed. G. R. Meneely, Charles C. Thomas, Springfield, Ill., pp. 249-265, 1961.

Gm phenotypes and genotypes in U. S. Whites and Negroes; in American Indians and Eskimos; in Africans; and in Micronesians.

A. T. Steinberg, R. Stauffer, B. S. Blumberg, H. Fudenberg.

*Am. J. Human Genetics* 13: 205-13, 1961.

Medical survey of Rongelap people seven years after exposure to fallout.

R. A. Conard, H. E. MacDonald, L. M. Meyer, S. Cohn, W. W. Sutow, D. Karnofsky, A. A. Jaffe, and E. Riklon.

BNL Report 727 (T-260), May, 1962.

Use of a portable whole-body counter to measure internal contamination in a fallout-exposed population.

S. H. Cohn, R. A. Conard, E. A. Gusmano, and J. S. Robertson. **DOE ARCHIVES**  
*Health Physics* 9: 15-23, 1963.

Medical survey of Rongelap people eight years after exposure to fallout.

R. A. Conard, L. M. Meyer, W. W. Sutow, W. L. Moloney, A. Lowrey, A. Hicking, and E. Riklon.

BNL Report 780 (T-296), January, 1963.

Metabolism of fission products in man: Marshallese experience.

S. H. Cohn.

I.A.E.A. Int. Symp. on Diagnosis and Treatment of Radioactive Poisoning, 15-18 October 1962, Vienna. International Atomic Energy Agency, Austria, pp. 235-251, 1963.

Long Term intra-oral findings in humans after exposure to total body irradiation from sudden radioactive fallout. I. Five years post-detonation studies.

H. W. Lyon, R. A. Conard, and K. F. Glassford.

J. Amer. Dent. Assoc. 68: 49-56, 1964.

Acute whole-body radiation injury: Pathogenesis, pre- and post-protection.

V. P. Bond, E. P. Cronkite and R. A. Conard.

In: ATOMIC MEDICINE. Chapter 10, 4th Edition, Ed. C. F. Behrens, The Williams and Wilkins Co., Baltimore, pp. 190-221, 1964.

Fallout radiation: Effects on skin.

R. A. Conard, E. P. Cronkite, and V. P. Bond.

In: ATOMIC MEDICINE, Chapter 12, 4th Edition, Ed. C. F. Behrens, The Williams and Wilkins Co., Baltimore, pp. 281-302, 1964.

Providing for the settlement of claims of certain residents of the Trust Territory of the Pacific Islands.

Report No. 1257 from the Committee on Interior and Insular Affairs, 2nd Session of the 88th Congress, Washington, July 29, 1964. (To accompany H. R. 1988).

Health aspects of nuclear weapons testing.

G. M. Dunning

U. S. Government Printing Office OL-729-548, Superintendent of Documents, Washington, D. C., 56 p., 1964.

Cesium-137 and strontium-90 retention following an acute ingestion of Rongelap food.

E. P. Hardy, Jr., J. Rivera, and R. A. Conard.

Presented at the Second Conference on Radioactive Fallout from Nuclear Weapons Tests, Germantown, Maryland, 11/3-6/64.

In: AEC 5th Symposium Series, "Radioactive Fallout from Nuclear Weapons Tests," Ed. A. W. Klement, Jr. USAEC Conf.-765, pp. 743-57, 1965 **DOE ARCHIVES**

Growth status of children exposed to fallout radiation on Marshall Islands.

W. W. Sutow, R. A. Conard, and K. M. Griffith.

Pediatrics 36(5): 721-731, 1965.

Effects of ionizing radiation in children.

W. W. Sutow and R. A. Conard.

J. Pediatrics 67(4): 658-673, 1965.

Medical findings in Marshallese people exposed to fallout radiation:  
Results from a ten-year study.

R. A. Conard, and H. Hicking.

J. Am. Med. Assoc. 192 (6): 457-459, 1965.

Medical survey of the people of Rongelap and Utirik Islands nine and ten years after exposure to fallout radiation (March 1963 and March 1964).

R. A. Conard, L. M. Meyer, W. W. Sutow, A. Lowrey, B. Cannon, W. C. Moloney, A. C. Watne, R. E. Carter, A. Hicking, R. Hammerstrom, B. Bender, I. Lanwi, E. Riklon, and J. Anjain.

BNL Report 908 (T-371), May, 1965.

Fallout of the cold war.

Editorial

New Eng. J. Med. 274 (25): 1462-1463, June 23, 1966.

Elevation of the serum protein-bound iodine level in inhabitants of the Marshall Islands.

J. E. Rall, and R. A. Conard.

Am. J. Med. 40 (6): 883-886, 1966.

Thyroid nodules as a late sequela of radioactive fallout in a Marshall Island population exposed in 1954.

R. A. Conard, J. E. Rall, W. W. Sutow.

New Eng. J. Med. 274: 1392-1399, 1966.

Aging studies in a Marshallese population exposed to radioactive fallout in 1954.

R. A. Conard, A. Lowrey, M. Eicher, K. Thompson, W. A. Scott.

Presented at the Colloquium on Radiation and Aging, Semmering, Austria, June 23-24, 1966. In: RADIATION AND AGEING. Eds. P. J. Lindop and

G. A. Sacher. Taylor and Francis, Ltd., London, pp. 345-360, 1966.

Medical Survey of the People of Rongelap and Utirik Islands Eleven and Twelve Years After Exposure to Fallout Radiation (March 1965 and March 1966).

R. A. Conard, W. W. Sutow, L. N. Meyer, J. S. Robertson, J. E. Rall, J. Robbins, J. E. Jesseph, J. B. Deisher, A. Hicking, I. Lanwi, M. Eicher and E. A. Gusmano.

BNL Report 50029 (T-446), April, 1967.

**DOE ARCHIVES**

Chromosome Studies on Marshallese Islanders Exposed to Fallout Radiation.

H. Lisco and R. A. Conard.

Science 157: 445-447, 1967.

Late Effects of Radioactive Iodine in Fallout.

J. Robbins, J. E. Rall, and R. A. Conard.

Ann. Int. Med. 66: 1214-1242, 1967.

Further Developments of Thyroid Nodules in the Marshallese Population  
Accidentally Exposed to Radioactive Fallout in 1954.

R. A. Conard.

Suffolk Co. Med. Soc. Bull. 1967 (March), p. 25.

Fallout Radiation: Effects on the Marshallese People.

R. A. Conard, E. P. Cronkite, V. P. Bond, J. Robertson and S. W. Cohn.

In: ATOMIC MEDICINE. Chapter 12, 5th Edition. Eds. C. F. Behrens, E. D. King  
and J. W. J. Carpender. Williams and Wilkins Co., Baltimore, 1969.

Thyroid Nodules as a Late Effect of Exposure to Fallout.

R. A. Conard, W. W. Sutow, B. P. Colock, B. M. Dobyns and D. E. Paglia.

I.A.E.A. Symposium on Radiation-Induced Cancer. International Atomic  
Energy Agency, Vienna, 1969. pp. 325-335.

Effects of Fallout Radiation on Marshallese Children.

W. W. Sutow and R. A. Conard.

In: RADIATION BIOLOGY OF THE FETAL AND JUVENILE MAMMAL. Eds. M. R. Sikov  
and D. D. Mahlum. Ninth Hanford Biology Symp., Richland, Washington,

May 5-9, 1969. AEC Symp. Series 17. USAEC-TID, Oak Ridge, Tenn. pp. 661-673.

Medical Survey of the People of Rongelap and Utirik Islands Thirteen, Fourteen  
and Fifteen Years After Exposure to Fallout Radiation (March 1967, March 1968,  
and March 1969).

R. A. Conard, W. W. Sutow, A. Lowrey, B. P. Colock, A. Hicking, M. Emil,  
D. E. Paglia, C. F. Demaise, J. L. Bateman, B. M. Dobyns, and E. Riklow.  
BNL Report 50220 (T-562), June, 1970.

Possible Radiation-Induced Aging as Measured by Immuno-Hematological Changes  
in Fallout.

R. A. Conard.

Proc. Fourth International Congress in Radiation Research, Evian, France,  
June 22-July 4, 1970.

Thyroid Neoplasia as a Late Effect of Acute Exposure to Radioactive Iodine in  
Fallout.

R. A. Conard, B. M. Dobyns and W. W. Sutow.

DOE ARCHIVES

J. Am. Med. Assoc. 214: 316-324, 1970.

Immunohematological Studies of Marshall Islands Sixteen Years After Exposure  
to Fallout.

R. A. Conard, C. S. Demaise, W. A. Scott and M. Mikes.

J. Gerontology 26 (1): 28-36, 1971.