

Atomic

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Serial 805004

15 APR 1949

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To: Military Liaison Committee
To the Atomic Energy Commission
Washington, D. C.

Subj: Atomic Energy Activities of the Navy Medical
Department - Report of.

Ref: (a) Enclav Mastr Air of 12 September 1947

Encl: (A) Report of Project involving Atomic Energy under
the cognizance of the Bureau of Medicine and
Surgery, Navy Department

1. Pursuant to instructions contained in reference (a), sub-
ject report of the Atomic Energy research program under the
cognizance of this Bureau is forwarded herewith, in tripli-
cate. This report is for the period ending December 31, 1948.

2. When enclosure (A) is removed, this correspondence may be
downgraded to restricted.

By direction Chief, Bulet:

DECLASSIFIED
DOD DIR 5200.9

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mail or registered guard mail is authorized
in accordance with article 7-5,
UNITED STATES NAVY SECURITY
MANUAL FOR CLASSIFIED MATTER

C. F. BERRINS
Captain, MC, USN

col (v/mar)
CFO (Op-36)
ASST
Bulet (57)
Bulet 71
Bulet 743

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By mail 4131 (You classify files)

File 52-73-002, Box 1 Files Atomic 1946-64

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Page 1 of 9 Pages.
Copy 12 of 12 Copies."

1. Code name of project.

Naval Medical Research Institute
Bethesda, Maryland
(Atomic Energy Medical Group)

2. Official Sponsorship.

a. Name of war or Navy Department agency controlling the project, and of others having primary interest in the project.
Bureau of Medicine and Surgery, Navy Department.

b. If contract was administered by Manhattan District or Atomic Energy Commission for another agency, describe relationships.
Not applicable.

c. Name and position of proper contact man in sponsoring agencies for MLO.
Captain R. H. Draeger, MC, USN
Head, Research Branch
Atomic Defense Division
Bureau of Medicine and Surgery
Navy Department.

3. Contractor or Working Agency (for each prime contractor and principal sub-contractors).

a. Name of contractor
National Naval Medical Center,
Bethesda, Maryland.

b. Names of associated prime and/or sub-contractors, and relationship.
None.

c. Name of contractor's employee responsible for project.
Captain C. F. Behrens, MC, USN
Medical Officer in Command
Naval Medical Research Institute
National Naval Medical Center
Bethesda, Maryland

d. Name of proper contact man for MLO.
Captain R. H. Draeger, MC, USN

e. Names of key members of technical staff engaged on project. Show fraction of each man's time devoted to project.

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Emil (A)

DECLASSIFIED PER EXECUTIVE ORDER 12356, SECTION 3.3, AND PROJECT NUMBER NMRS 947527 BY RB/VSK, DATE 6/21/94

Commander R. H. Lee, MSC, USN	Full Time
Commander J. L. Tullis, MC, USN	Full Time
Lt. Commander E. P. Cronkite, MC, USN	Full Time
Lt. Commander F. W. Chambers, Jr., MSC, USN	50%
Dr. F. F. Ellinger, M.D. Chief Radiobiologist	Full Time
Mr. M. Eicher, P-3, Electronics and Dosimetry	Full Time

4. Nature of Work.

a. Principal objectives in terms of ultimate application, if any.

The Atomic Energy Medical Research Program of the NMRI is directed toward the prevention, diagnosis and therapy of injuries to personnel exposed to the hazards of the atomic bomb or other uses of atomic energy.

b. Brief description of research and development program.

(1) Relationship of principal parts of program to the above objectives.

- (a) Blast studies.
- (b) Thermal radiation studies.
- (c) Ionizing radiation studies.
- (d) Dosimetry.
- (e) Psychological studies.

(2) Major technical problems toward the solution of which the program is directed.

(a) Determination of injuries to man by air blast and its dependence upon intensity and wave form.

(b) Determination of the prophylaxis and therapy of atomic bomb thermal radiation injuries. Also the degree of injury to man resulting from atomic bomb thermal radiations, and its dependence upon intensity and spectral distribution; and, determination of the protective value of clothing and other materials.

(c) Ionizing radiation studies including the following:

(1') The effects of ionizing radiation, ranging from permissible to lethal doses.

(2') The action of pharmacological agents upon effects of ionizing radiation.

(3') The relation of nutrition to the effects of ionizing radiation.

(4') The basic biological changes due to ionizing radiation including biochemistry, physiology, histology and hematology.

(5') Factors influencing radiation fitness.

(6') The low level radiochemical determination of radioisotopes in animal and human tissue.

(d) Methods of rapidly estimating the dose of ionizing radiation received by casualties applicable to large population masses.

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(a) To determine psychological aspects of atomic warfare as regarding Naval efficiency.

(3) Avenues of approach to such problems, which:

(a) Have already given success.

(1') Blast studies.

(a') Air blast studies at Bikini, with rats, indicate that direct air blast injury occurs at lower peak pressures than with ordinary explosives.

(2') Thermal radiation studies.

(a') Cloth samples of materials of various weights and colors were exposed to thermal radiations from the Bikini atomic bombs. Similar samples have been studied in the laboratory and considerable information obtained concerning the intensity and quality of radiation and the protective value of the materials.

(3') Ionizing radiation studies.

(a') Investigation with small animals have established tentative dosage values producing mortality rates ranging from 10 to 100 percent.

(b') A number of pharmacological agents including, desoxycorticosterone, folic acid, and pyridoxine, methylene blue, protamine, rutin, etc., have been studied in relation to radiation illness in animals. These studies indicate that the cause of radiation illness may be modified by pharmacological agents.

(c') A study of Japanese atomic bomb casualties indicates that malnutrition probably increased radiation illness mortality. This is a comparatively new field and little experimental work has been done.

(d') The gross and histopathology of ionizing radiation injury has been studied in the animals. The gross and histopathology of ionizing radiation injury has also been studied in swine exposed to 1000 KV total body x-irradiation.

(e') Little experimental work has been done on the problem of radiation fitness. A low metabolic rate favors survival. The great variation in mortality rate in animals exposed to ionizing radiation suggest that there are factors predisposing to radiation illness.

(f') Radioautographic methods have been successfully applied to the determination of low levels of plutonium and fission products in animal tissues. These techniques are applicable to the estimation of hazards in contaminated areas.

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(4') Dosimetry.

(a') Vicor rods were successfully used at Bikini to estimate the dose of ionizing radiation in experimental animals. Activated potassium bromide crystals have been developed which show marked color changes with 100 r. 200 K.V. x-rays.

(5') Psychological studies.

(a') None.

(3) Avenues of approach to such problems which:

(b) Are now being worked on.

(1') Blast studies.

(a') The construction of a 12-inch modified shock tube air blast generator.

(2') Thermal radiation studies.

(a') The physical study of materials exposed to thermal effects at Bikini and Eniwetok is being continued.

(3') Ionizing radiation studies.

(a') A cobalt gamma ray generator is under construction which will be used in connection with all ionizing radiation research.

(1'a') Lethal dose studies are underway utilizing several animal species.

(1'b') Sulfhydryle containing pharmacological agents are being currently investigated with regard to the effect upon radiation illness.

(1'c') The relation of nutrition to tooth development and decay in irradiated animals is now being studied.

(1'd') The gross and histopathology of ionizing radiation injury is being currently studied in mice exposed to 1000 R.V. total body x-irradiation. The mice are being serially autopsied at hourly intervals after irradiation in order to study the pathologic sequence of events.

(2'a') Swine are also being exposed to 2000 K.V. total body x-irradiation from one and both lateral aspects in order to determine the difference in mortality. The effect of total body irradiation on the phagocytic properties of the reticuloendothelial system is being studied in rabbits.

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(1'e') The effects of induced immunity to bacterial toxins is being investigated in relation to radiation fitness also the correlation of certain clinical findings to predisposition to radiation illness in patients undergoing radiation therapy.

(1'f') Animal tissues are being examined for plutonium content by spinal radioautographic techniques suitable for very low level determinations.

(4') Dosimetry.

(a') Work is being continued on the activated potassium bromide crystal dosimetry.

(5') Psychological studies.

(a') A preliminary survey of the available literature on psychological aspects of atomic warfare is being made to determine the possible scope of future activities.

(3) Avenues of approach to such problems which:

(c) Are planned for future work.

(1') Blast studies.

(a') It is planned to conduct air blast experiments upon small animals to determine the relation of mortality to peak pressure and wave form.

(2') Thermal radiation studies.

(a') It is planned to conduct thermal burn studies on animals and human subjects to determine the relation between degree of burn and distance from an atomic bomb and the protection afforded by various clothing materials.

(3') Ionizing radiation studies.

(a') An attempt will be made to correlate the physiological effects of ionizing radiation when administered as single dose or as repeated doses. Lethal and tolerance dose studies are planned to relate quality and quantity of radiation with mortality rates in several animal species. An attempt will be made to extrapolate this data to man by isolating the factors determining the interspecies differences.

(b') It is planned to continue the investigation of the effects of pharmacological agents upon radiation illness. It is impossible to predict the direction of this work since it will be constantly modified in the light of new data.

(c') It is planned to continue a study of the relation of nutritional factors to susceptibility to radiation illness and the therapy of radiation illness.

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(d') It is planned to continue to study the gross and histopathologic of total body ionizing radiation in various animal species. It is planned to study the differences in mortality in swine exposed to 1000 K.V. and 2000 K.V. total body x-irradiation delivered to one and to both lateral aspects of the animals. It is planned to study the composition, rate of flow and toxicity of the lymph in dogs exposed to total body irradiation. As a corollary to this problem capillary permeability in irradiated dogs will be studied.

(e') It is planned to continue the investigation of factors related to fitness both from the standpoint of selection of radiation-resistant individuals and artificially induced immunity to radiation illness. This project has received encouragement from groups needing this information notably the ARA project.

(f') It is planned to continue the low level determination of plutonium and fission product content of animal tissues exposed in contaminated areas under various conditions. These studies are related to plans for future field tests of atomic weapons.

(g') Extensive plans are being made for participation in future field tests of atomic weapons.

(4') Dosimetry.

(a') It is planned to continue work on methods of rapidly estimating the dose of ionizing radiation. Specifically by study of activated potassium bromide crystals and related crystal compounds.

(5') Psychological studies.

(a') No plans for psychological studies will be formulated until preliminary surveys are completed.

(4) List of principal current sub-projects now active.

(a) A study of air blast injury in experimental animals as related to intensity and wave form.

(b) Lethal dose studies with external radiation: Mathematical analysis of the relation between the physiological effects of single and repeated doses of ionizing radiation.

(c) Lethal dose studies with external radiation: Determination of the lethal dose of total body x-irradiation of swine.

(d) Lethal dose studies with external radiation: Acute exposure to external ionizing radiation.

(e) Nutrition and the response to ionizing radiation: Studies related to survival at high.

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- (f) Physiological and histologic effects of ionizing radiation: Effect on tooth development, oral tissues and fluids.
 - (g) Physiologic and histologic effects of ionizing radiation: The measurement of adrenal function in acute total body irradiation.
 - (h) Influence of pharmacological agents on effects of external irradiation: The evaluation of sulfhydryl-containing agents upon the course of radiation injury.
 - (i) Studies in radiation fitness: The effects of induced immunity.
 - (j) The hemorrhagic syndrome in acute radiation illness and the relation to circulating anticoagulants.
 - (k) Physiologic and histologic effects of ionizing radiation: The pathologic sequence of events in mice exposed to 1100 r. total body x-irradiation.
 - (l) Physiologic and histologic effects of ionizing radiation: Study of the function of the reticulo-endothelial system after total body irradiation.
 - (m) Radiation fitness: Correlation of predisposition to radiation illness to other clinical findings in patients receiving radiation therapy.
 - (n) Radiobiochemistry: The determination of low level radioactivity in animal tissues.
 - (o) Physiologic and histologic effects of total body irradiation: Response of irradiated animals to bacterial substances.
 - (p) Physiologic and histologic effects of ionizing radiations: Study of the lymph in irradiated dogs.
- (5) General description of status and time scale as of date of report.

(a) Progress under this program is best revealed by a review of the list of reports in paragraph 6. The work on most phases was initiated at Bikini and has been steadily gathering momentum in spite of inadequate personnel and equipment. Many of the handicaps are gradually being overcome and major results should be anticipated within the next 12 to 18 months.

(c) Bibliography of reports prepared to date.

(a) Report No. 1 1 Dec 47 Incidental finding of megakaryoblastic-like cells in bone marrow of one of two dogs with macrocytic anemia and acidophiluria. F. L. Lawrason and E. P. Cronkite.

(b) Report No. 2 16 Dec 47 Correlation between the mean corpuscular volume and reticulo-cytosis in phenylhydrazine anemia. F. L. Lawrason, B. C. Eltzholtz and P. K. Schork.

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(c) Report No. 3 22 Dec 47 The lethal dose of total body x-ray irradiation in swine. J. L. Tullis, C. F. Tessmer, E. P. Cronkite and P. G. Chambers.

(d) Report No. 4 23 Dec 47 A method for the titration of heparin-like substances in plasma. F. W. Ullrich and E. P. Cronkite.

(e) Report No. 5 30 Jan 48 The acceleration of plasma coagulation by low concentrations of heparin. E. P. Cronkite and F. W. Ullrich.

(f) Report No. 6 2 Mar 48 The use of taka-diastase and papain in the determination of folic acid. G. Wolcott.

(g) Report No. 7 29 Mar 48 Studies on the toxicity and anti-heparin action of protasins in the goat. A. S. Rashkind.

(h) Report No. 8 3 April 48 The diagnosis of ionizing radiation injury by physical examination and clinical laboratory procedures. E. P. Cronkite.

(i) Report No. 9 9 June 48 A species variation in prothrombin determinations on using several thromboplastic agents. G. H. Lawrence and E. P. Cronkite.

(j) Report No. 10 19 Jul 48 The clinical manifestations of acute radiation illness produced by goats by exposure to an atomic bomb, Test Able, Bikini, 1946, with comments on therapy. E. P. Cronkite.

(k) Report No. 11 22 Jul 48 The response of tissue to total body irradiation. J. G. Tullis.

(l) Report No. 12 28 Jul 48 The spontaneous leukocyte and temperature variation in untreated rabbits studied under controlled conditions. R. S. Farr, P. K. Schork and G. H. Gayhart.

(m) Report No. 13 30 Jul 48 The effect of subcutaneous and intravenous injection of adrenal cortical extract on peripheral leukocytes and body temperature of rabbits. R. S. Farr, V. J. Lequire, P. K. Schork and G. H. Gayhart.

(n) Report No. 14 13 Aug 48 A method for the simultaneous exposure of large numbers of animals to single dose high intensity total body x-ray irradiation. W. H. Chapman, C. R. Sipe, D. C. Eltzholtz, E. P. Cronkite, G. H. Lawrence, and P. G. Chambers.

(o) Report No. 15 17 Aug 48 The increased tolerance of mice to a lethal dose of x-ray radiation as a result of previous sublethal exposures. E. P. Cronkite, C. R. Sipe, D. C. Eltzholtz, W. H. Chapman and P. G. Chambers.

(p) Report No. 16 19 Aug 48 Failure of rutin to decrease the mortality of acute ionizing radiation illness in mice. E. P. Cronkite, D. C. Eltzholtz, C. R. Sipe, W. H. Chapman, and P. G. Chambers.

(q) Report No. 17 27 Sep 48 The augmentation of the pyretic and leukocytic effects of typhoid vaccine by homologous plasma in the rabbits. R. S. Farr, V. J. Lequire, P. K. Schork and G. H. Gayhart.

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(r) Report No. 18 30 Sep 48 The failure of folic acid to alter the clinical course and hematologic picture of fatal single total body irradiation in swine. E. P. Cronkite, J. L. Tullis, C. Tesser, F. W. Ulrich.

(s) Report No. 19 3 Jan 49 A critical analysis of the syndrome of acute total body irradiation illness, its role in atomic warfare and its influence on the future practice of military medicine. E. P. Cronkite, and R. H. Chapman.

(t) Report No. 20 11 Mar 49 The reaction between heparin and fibrinogen. S. J. Haskind, W. Ireland and J. G. Galt.

(u) Report No. 21 7 Apr 49 The response of the peripheral blood of swine to whole body x-ray radiation in the lethal range. E. P. Cronkite, F. W. Ulrich, S. J. Haskind, W. Ireland and J. G. Galt.

(5) Funds.

a. Source (appropriation)

Medical Department, Navy.

b. Total appropriated for project.

Miscal accounting of individual studies has not been attempted, but based on salaries, material, etc. A reasonable estimate of that portion of NRI appropriation for planning objective 06 is: \$116,612.00.

c. Amount expended as of date of report.

\$100,350.00. (Includes direct and indirect costs; pay of civil employees, maintenance pro-rated, etc.)

d. Amount expended in month preceding the month report is dated. (i.e., November if report is dated 31 December)

Present accounting procedures do not reveal this information. No monthly breakdown of costs of specific projects has been undertaken.

e. Amount in budget for next fiscal year.

Estimated requirements for FY 1950 are as follows:

(1) For research in program outlined in paragraph (1) above, at NRI: \$200,000.00