

PROPOSED NME BIOLOGY AND MEDICINE ATOMIC BOMB TEST PROJECTS

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Project M-1 - Early pathological changes in radiation illness.

Objective: To obtain animal tissues for pathological study during the first 24 hours following exposure to intense ionizing radiation.

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Method: The experimental design anticipates the use of equipment developed under Project 7.1-17/RS(BM)14 at Eniwetok during Operation SANDSTONE. Four (4) animal tanks suitable for pigs or dogs were tested on land and on floats off-shore during tests X-RAY and Yoke. The tanks on rafts were least damaged and most readily recovered. It is planned to place about 24 animals per test in 12 tanks on floats to be anchored off-shore at distances from about 400 to 700 yards. These tanks are to be recovered as soon as possible after detonation and the animals autopsied at predetermined time intervals during the first 24 hours.

Justification: We have little information regarding the early pathological changes in radiation illness. It cannot be obtained from either the Japanese or Bikini data or in the laboratory except with great difficulty. The contemplated experiments will furnish information in this phase of the radiation illness problem.

Project M-2 - Relation of distance and physical data to morbidity and mortality in animals.

- Part a. Air blast study.
- Part b. Thermal radiation study.
- Part c. Ionizing radiation study.
- Part d. Combined effects.

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Objective: The objectives of this project are essentially four-fold and relate to the subdivisions of the title, Parts a, b, c, and d. An attempt will be made to determine the relative importance of blast, flashburns and ionizing radiation with regard to morbidity and mortality in several animal species such as mouse, rat, guinea pig, rabbit, dog, and pig. The individual objectives are as follows:

- a. To study direct air blast injuries in several animal species with regard to peak pressure and duration of shock wave, also mechanism of injury.
- b. To study the relation of mortality to surface area and degree of burn. To correlate the pathological skin changes with the intensity and quality of the thermal radiation. To compare the physiological changes in skin produced by atomic bomb flashburns with laboratory produced flashburns.
- c. To study the effects of ionizing radiation upon several animal species at various distances from the bomb explosion and to correlate these effects with intensity and quality of the radiation. Also to compare the known mortality of the various animal species from 1,000 k.v. X-rays to that of atomic bomb ionizing radiation.

DEPARTMENT OF ENERGY DECLASSIFICATION REVIEW	DETERMINATION (CIRCLE NUMBER(S))
	1. CLASSIFICATION RETAINED 2. CLASSIFICATION CHANGED TO: 3. CONTAINS NO. DOE CLASSIFIED INFO 4. COORDINATE WITH: 5. CLASSIFICATION CANCELLED 6. CLASSIFIED INFO BRACKETED 7. OTHER (SPECIFY):
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d. To investigate the combined effects of blast, thermal and ionization radiation upon similar groups of several animal species as used in Parts a, b, and c. An attempt will be made to determine the contribution of each of these factors to morbidity and mortality by differential comparison.

Method: It is planned to expose large groups of several animal species to give statistically reliable data under the following four experimental conditions.

- a. Exposure to primary air blast injuries in cages designed to give protection against thermal and ionizing radiation.
- b. Exposure to thermal radiation in cages designed to protect against blast and ionizing radiation. These studies will include the susceptibility of flashburns complicated by ionizing radiation to various organisms as staphylococci, streptococci, and clostridium species.
- c. Exposure to ionizing radiation providing complete protection against blast and thermal radiation.
- d. Exposure to the combined effects of air blast, thermal and ionizing radiation in cages designed to give indirect blast injury protection only. Studies will also be made of the normally occurring bacterial flora of the respiratory, gastro-intestinal and mucous membrane surfaces of these animals.

After exposure the various groups of animals will be removed as soon as possible and returned to the breeding colony (see Project 6) for study and disposition. Most of the animals will be autopsied at predetermined intervals to follow the physiological and pathological changes related to the several types of injury. It is anticipated that few, if any, animals will be returned alive to the United States. However, a very large number of tissue specimens will be preserved for study. It will be necessary to autopsy a rather large number of dead animals immediately upon recovery. It is considered that this can best be done aboard the laboratory ship (see paragraph 4). These studies to include the bacterial examination of the respiratory and gastro-intestinal tracts.

Justification: Carefully controlled and statistically reliable tests correlating animal morbidity and mortality with type of injury and distance are indicated in order to relate laboratory and field test data. The Bikini tests are inadequate for this purpose since too few animals were located at any one station and factors other than distance varied markedly from station to station.

Comments:

Part a. Cages suitable for the exposure of animals to direct air blast effects were developed at Inyokern under the direction of Captain R. H. Draeger prior to Bikini. Modifications to isolate the injurious factors are planned together with further testing of the equipment.

Part b. The thermal studies at Bikini and Eniwetok form the background for this investigation. Collaboration has also been arranged with Dr. H. E. Pearse, University of Rochester, who will assume the major responsibility of the flashburn study and supply several assistants.

Parts c and d. The extensive studies of the Bikini animals and lethal dose studies in various animal species at NMRI will be invaluable in these phases of the radiation illness study. A strain of mice is being bred at the NMRI which is hardy, prolific, and presents a uniform response to 1,000 k.v. X-rays. Comparable rat, guinea pig, rabbit, dog and pig breeding stock can be obtained.

Project M-3 - Effects of ionizing radiation on biological warfare agents.

Objective: To study the reaction of B.W. agents to atomic bomb ionizing radiation with respect to survival and genetic changes.

Method: Selected B.W. agents will be prepared by the Chemical Corps, Camp Detrick, for exposure to atomic bomb ionizing radiation. This material will then be exposed in containers similar to those used during Operation SANDSTONE. Upon recovery this material will be removed to an isolated laboratory for study.

Justification: Since B.W. agents and A.W. agents might be employed together, it is important to determine the effects of ionizing radiation upon B.W. agents. It is known that a heavy dose of ionizing radiation (25 to 50,000 r) will kill a large percentage of most bacteria. However, little is known regarding the virulence of the surviving organisms or the effect of smaller doses of radiation on the particular organisms under consideration.

Comment: Experience with the packaging of biologic materials both at Bikini and Eniwetok make possible the exposure of this material without hazard. None of the containers used at Eniwetok were broken open in spite of having been placed very near to the bomb explosion.

Project M-4 - Effect of ionizing radiation on resistance to B.W. agents.

Objective: To study the reactions of experimental animals receiving sublethal amounts of ionizing radiation to B.W. agents with respect to resistance to infection and pathological changes.

Method: Normal experimental animals will be exposed to sublethal doses of atomic bomb ionizing radiation and then exposed to B.W. agents in isolated laboratory.

Justification: It is known that the susceptibility of laboratory animals to certain bacterial infections is increased by total body irradiation. Also one of the serious complications of radiation illness is secondary infection. These facts suggest that B.W. agents may be more effective if combined with sublethal doses of ionizing radiation. It is possible that small doses, producing little or no symptomatology, may exert a marked effect on susceptibility to comparatively non-virulent organisms. This project is planned to investigate these problems.

Project M-5 - Effects upon B.W. agents - simulants.

Objective: To expose selected B.W. agents to the effects of an atomic bomb explosion (blast, thermal and ionizing radiation).

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Method: It is planned to establish an animal breeding colony on one of the islands near Eniwetok island perhaps Japtan during the summer of 1949 for the purpose of raising laboratory animals of several species for the atomic bomb tests in 1951. The species contemplated are the mouse, rat, guinea pig, rabbit, dog, and pig.

Justification: Experience at Bikini has shown that the transportation of laboratory animals into the tropics produced marked physiological changes such as variation in the red blood cell counts which make the interpretation of experimental data very difficult. Animals raised under tropical conditions would be more satisfactory, also steps could be taken to habituate the animals to the particular environmental exposure to which they would be subjected during the exposure to atomic bomb effects.

Project M-10 - Effect upon flora and fauna.

Objective: To study the effects of atomic bomb thermal radiation upon the animal and plant life such as birds, insects, and various plants.

Method: In order to implement the objective of this project arrangements have been made with agencies such as the Smithsonian Institute and Department of Agriculture to furnish qualified personnel to survey various forms of life before and after the bomb detonations. To be included are Invertebrate Biologist, Botanist, Entomologist, Ornithologist, Bacteriologist, and Microbiologist.

Justification: Marked effects were noted upon certain of the plant and animal life at Eniwetok. For example: hundreds of birds were grounded due to the singeing of the wings, the leaves of plants and trunks of trees were scorched in varying degrees. It appears likely that a survey of the effects of atomic bomb thermal radiation likely that a survey of the effects of atomic bomb thermal radiation upon plant life serve as a valuable guide to the location and tonage of an atomic bomb explosion. No systematic study of these effects has, as yet, been made.

Project M-11 - The exposure of selected biologic material.

Objective: To expose selected biologic material such as seeds, insects, moulds, enzymes, hormones, etc., to atomic bomb ionizing radiation.

Method: It is planned to construct containers similar to those used at Eniwetok to expose a variety of biologic material as above enumerated.

Comment: This project will include material from the NRDL, the NMRI, and USDA. Space will be available to expose material desired by other groups for study as was done for various collaborators at Bikini and Eniwetok.

Project M-12 - Uptake of radioactive material by plants and animals.

Objective: To determine the amount of uptake of radioactive material by plant and animal life in areas contaminated by an atomic bomb explosion.

Method: It is planned to study various forms of plant and animal life in the contaminated area with respect to uptake of radioactive substances. This will be accomplished by the sampling of the naturally occurring forms of life such as plants, insects, and birds.

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Comment: The responsibility for certain phases of this project will be assumed by the USDA who will supply several personnel.

Facilities: In order to implement the projects the following facilities will be needed. It is expected that these facilities will be jointly used by NRI, NRDL and other collaborators mentioned in connection with the various projects. These facilities would also be available to other investigators desiring to extend the scope of these studies.

- a. Animal breeding colony. See Project M-9.
- b. Biological laboratories on same island as (a).
- c. Laboratory ship - this laboratory would include both physical and biological laboratories and be shared by NRDL, NRI, and other collaborators.
- d. Isolated laboratory - this laboratory is to be used by the Chemical Corps for projects M-3 and 4. There is no plan to contaminate this island, the isolation being merely a safety precaution since B.I. agents will be handled.

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