THE ORGANIZATION OF RADIATION RESEARCH FOR THE LIFE SCIENCES IN THE DEPARTMENT OF DEFENSE

The Director of Defense Research and Engineering has ultimate responsibility for all of the Defense Department programs included in this report. However, the Army, Navy, and Air Force are the principal operating organizations which plan, support, and coordinate research and education in radiobiology through grants, contracts, and work in laboratories maintained by the three services.

The Department of the Army is responsible for the preparation of land forces necessary for the effective prosecution of war. The preparation of these land forces for nuclear war must include the attainment and dissemination of detailed knowledge of the biological effects of ionizing radiation; i.e., a suitable research program and subsequent training. Resources of the Army to accomplish the research and training goals include the Division of Nuclear Medicine and Chemistry at Walter Reed Army Institute of Research, the U. S. Army Medical Research Laboratory at Fort Knox, the U. S. Army Medical Research Unit at Landstuhl, Germany, the Radiological Laboratory at the Army Chemical Center, the Radiological Operations Division at the Chemical Corps Proving Ground, the Quartermaster Food and Container Institute at Chicago, the Quartermaster Research and Engineering Laboratories, extra-mural research contracts and various training installations of the U. S. Army.

In broad terms the Surgeon General of the Navy is responsible for safeguarding the health of personnel in the naval service. The Navy has become a principal user of nuclear power and must also deal with the special problems which arise from the possibility of nuclear warfare at sea. Hence research on the biological effects of radiation and on methods for decontaminating vessels and protecting personnel is essential for successful accomplishment of its mission. The Naval Radiological Defense Laboratory at San Francisco and the National Naval Medical Research Institute at Bethesda conduct most of the research in these areas presently being supported by the Navy. Extramural support through grants and contracts to scientific institutions is handled primarily by the Office of Naval Research and the Bureau of Medicine and Surgery. However, the extramural program of the Office of Naval Research has not emphasized radiation biology since the establishment of an extramural program by the Atomic Energy Commission. Prior to that time, however, ONR administered the AEC program with the aid of transferred funds.

Naval officers are trained for duties involving clinical application of radioisotopes, radiology, radiobiology, medical aspects of warfare, medical aspects of nuclear propulsion, etc. Training may be received at any of the following: University of Rochester, radiobiology; Reed College, radiobiology; U. S. Naval Medical School, radioisotopes; Oak Ridge Institute of Nuclear Science, radiobiology; U. S. Naval Post Graduate School, nuclear engineering (effects); Naval Schools Command, Treasure Island, medical aspects of modern warfare; residency training at approved naval or civilian hospitals, radiology.

In the Air Force, it is the responsibility of the Air Research and Development Command to conduct biomedical and radiobiological research as it relates to (1) the testing, maintenance, and use of Air Force atomic weapons systems, and (2) the Air Force applications of nuclear energy for power. ARDC is also charged with the development of radiation detection equipment and personnel protective equipment.

The Aerospace Medical Center (formerly the School of Aviation Medicine) has responsibility for evaluating the biological effects of radiation and analyzing anticipated radiation hazards. The varied types, ratios, energies, and schedules of nuclear radiation demanded for research represent an array of experimental radiation sources beyond the capabilities of any given installation or facility. Consequently, the challenges of the SAM program continue to be met by utilizing a combination of in-house, extra-mural studies, and by collaboration between Air Force and AEC facilities in fields of basic and applied research, teaching of the developed concepts of radiobiology both to scheduled classes at the School and in the form of guidance or advisory correspondence to concerned facilities.

TABLE A

BUDGETARY AND MANPOWER DATA FOR FISCAL YEAR 1959 (OBLIGATED)
DEPARTMENT OF DEFENSE RADIATION RESEARCH FOR THE LIFE SCIENCES

CATEGORY OF RADIATION RESEARCH	ARMY				NAVY				AIR FORCE				TOTAL			
	No. of Proj.	Funds $(1000's)	Prof.	Suptg.	No. of Proj.	Funds $(1000's)	Prof.	Suptg.	No. of Proj.	Funds $(1000's)	Prof.	Suptg.	No. of Proj.	Funds $(1000's)	Prof.	Suptg.
1. Biology	21	597	28.3	10.5	5	603	33	37	23	981	45	103.25	49	2181	106.3	150.75
2. Genetics	1	25	1.3	0.4	-	-	-	-	-	-	-	-	1	25	1.3	0.4
3. Environmental	2	67	3.5	0.9	-	-	-	-	2	48	3.0	2.7	4	115	6.5	3.6
4. Toxicology	27	859	45.0	13.0	-	-	-	-	1	25	1.0	.75	28	884	46.0	13.75
5. Protection	33	1084.3	57.8	16.4	1	14	1.0	0.5	2	163	4.7	14.2	36	1261.3	63.5	31.1
6. Agriculture	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
7. Medical Application	6	182	10.9	4.7	4	39.5	2.5	2.5	1	12	.3	1.0	11	233.5	13.7	8.2
8. Detection and Measurement	7	190.5	12.1	6.5	1	4	-	0.5	3	130	3.4	4.1	11	3245	15.5	11.1
9. Education, Training and Information	See Note				See Note				See Note							
TOTALS	97	3004.8	158.9	52.4	11	660.5	36.5	40.5	31	1359	57.4	126.0	140	5024.3	252.8	218.9

NOTE: Each service conducts training programs designed to meet the special needs of its missions. Since the ionizing radiation aspects of education, training, and information are an integral part of the entire effort in these fields, it is not possible even to estimate the funds or man-years devoted to this portion of the program.

TABLE B

ORGANIZATION OF RADIATION RESEARCH IN THE LIFE SCIENCES IN THE DEPARTMENT OF DEFENSE

CATEGORY OF RADIATION RESEARCH	DESCRIPTION OF PROGRAM	SUPERVISING AGENCY	LOCATIONS	DURATION	SIGNIFICANCE
1. Biology	a. Investigation of the effect of ionizing radiation on various organs of the body and on the biochemical components of these tissues. Emphasis is placed on the prompt short-term changes which occur in an effort to understand the underlying mechanisms which produce damage. Programs include study of the effect on blood forming tissue, changes in susceptibility to infection, the nature of radiation burns, and the rate of wound healing.	Army Medical Service Chemical Corps	Extramural contracts with Universities and Institutes Naval Radiological Defense Laboratory	Most programs are funded for two years or more.	As long as the possibility for nuclear warfare exists, the Armed Forces must be prepared to cope with injury caused by radiation. The military problem concerns, particularly, intermediate ranges of exposure about which relatively little is known and for which no rational therapy exists. Research on the fundamental mechanisms of radiation damage is therefore an important part of the over-all program.
	b. Determination of the safety and nutritional value of foods preserved by radiation. This includes long-term feeding experiments with mammals conducted under contract with Universities as well as projects carried out in Military laboratories. Part of this program, dealing with methods of sterilizing foods, is listed under item 2 and item 4 below.	Army Medical Service Quartermaster Corps	Extramural contracts with Universities and Institutes In-house programs at QM Food and Container Institute, Chicago QM Research & Eng. Center, Natick	"	Adequate nutrition is a prime necessity in maintaining the health, efficiency and morale of the soldier, especially in combat or under adverse conditions. Successful preservation of foods by radiation offers potential advantages in the storage and distribution of wholesome rations to troops.

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CATEGORY OF RADIATION RESEARCH		DESCRIPTION OF PROGRAM	SUPERVISING AGENCY	LOCATIONS	DURATION	SIGNIFICANCE
Biology	4.	The program supported by ONR includes studies on selective damage to parts of single cells by very narrow beams of radiation and measurement by new methods of free-radical found by ionizing radiation and observation of its effects on reproduction and cell fragmentation. The program at Naval laboratories is similar in many respects to Paragraph a above. Part of the work at Naval laboratories falls in categories 5 and 8.	Office of Naval Research Navy BuMed	Extramural contracts with Universities National Naval Medical Center Naval Medical Research Institute Naval Radiological Defense Laboratory	Most programs are funded for two years or more	In addition to the general military need to know more about the fundamental causes of radiation damage, the Navy has been especially concerned with problems of decontamination of ships and gathering data from which toleration of various levels of radiation by humans can be predicted.
	d.	The Air Force has emphasized studies of effects of acute and chronic whole-body radiation on large animals closely related to man and on changes produced by radiation on the central nervous system. Its program is in other respects similar to Paragraph 2 above.	Air Research & Development Command Air Force Office of Scientific Res. Aero Space Medical Center Wright Air Development Center AF Special Weapons Center	Extramural contracts Naval Radiological Defense Laboratory Extramural contracts also In-house Research Extramural — Extramural	"	The Air Force has special concern for protection of personnel obliged to undertake radiation risks in connection with operation of advanced nuclear weapons systems. The Air Force supports research at the Naval Radiological Defense Laboratory.
2. Genetics		The Army maintains one project to determine in experimental animals whether long-term feeding with food preserved by radiation can have any detectable genetic effects	Army Medical Service	University	Continuing	Part of general program for establishing safety of radiation-preserved foods

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3. Environmental	a. Measurement of fallout fission products and natural radioactivity in man.	Army Medical Service	Medical Research Unit (Germany) NYC, Bellevue Med Center Vanderbilt University Walter Reed Army Institute of Research	Continuing	Part of the United States program in monitoring fallout.
	b. Investigation of effects of radiations simulating certain types of cosmic rays on tissue.	Aerospace Medical Center	Contracts with Yale and Brown Universities	Continuing	Operation of manual vehicles in and above the upper stratosphere will present increased problems of protection against cosmic radiation the biological effects of which are largely unknown at present. The Air Force geophysics program includes research on the nature and occurrence of these radiations.
4. Toxicology	a. In connection with the Food Preservation Program the Army is studying whether chemical changes in foods preserved by radiation cause unfavorable effects in mammals.	Army Medical Service	Extramural Contracts with 25 Universities and Industrial concerns. Medical Research and Nutrition Laboratory, Denver.	Continuing	It must be ascertained whether any toxic products are formed by the interaction of ionizing radiations with the chemical constituents of foods during preservation. Determination of synergistic or protective effects.
	b. Evaluation of the combined effects of radiation and various mitotic poisons.	Chemical Corps	Chemical Warfare Laboratories		
	c. In cooperation with the AEC the Air Force is studying the toxicology of ingested plutonium.	AF Special Center	Hanford	Continuing	

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5. Protection	a. During FY 1959 the Army initiated an extensive program to develop a practical method of protection against radiation by use of chemicals.	Army Medical Service	Walter Reed Army Institute of Research 30 extramural contracts monitored by WRAIR.	Three Years	There is a pressing need for a practical means of protecting humans from the effects of radiation. Although the present stage of knowledge does not permit hope for absolute protection, optimum use of present information may lead to at least doubling resistance to radiation damage.
	b. Studies begun in 1958 suggest that a diet rich in certain vegetables improves the resistance of animals to wholebody radiation. If current experiments confirm this finding, efforts will be made to isolate the food constituents responsible for this protective effect and learn more about their mode of action.	Quartermaster Corps	QM Food & Container Institute and extramural contracts.		
	c, Theoretical and experimental studies on gamma and neutron shielding.	Chemical Corps	Chemical Warfare Laboratories	Continuing	Health Physics.
	d. Injection of bone marrow after exposure to radiation has been shown to improve the survival rate of animals. The Navy has been interested in immunochemical reactions which occur when marrow from one strain or species is injected to animals with different genetic characteristics. Possible therapeutic value of cell-free spleen extracts and phospholipid fractions is also being investigated.	BuMed	Naval Radiological Defense Laboratory Naval Medical Research Institute	Continuing Continuing	See previous sheet

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	e. Screening of compounds for their potential value as protective agents against radiation and study of the mechanism of such protection is conducted at the Air Force Radiation Laboratory.	Aerospace Medical Center	University of Chicago Albert Einstein Med. Center, Phila.	Continuing	
6. Agriculture	None	None	None	None	None
7. Medical Applications	a. Immunochemical and clinical studies on treatment of burns and local and systemic therapy including marrow transplantation.	Army Medical Service	Extramural contracts at 4 Universities	Continuing	Search for better burn and post-irradiation therapy.
	b. Chemical substances used in conjunction with radiation are being studied for their effect on lukemia. Bone marrow transplantation is being studied also.	Chemical Corps	Chemical Warfare Laboratories	Continuing	Isotopes and instrumentation developed for radiation biology provide opportunities to develop improved diagnostic tests and thus improve medical practice.
	c. New ways of using isotopes to diagnose and treat disease are being evaluated.	BuMed	National Naval Medical Center U.S. Naval Hospital St. Albans, N.Y. Ohio State University	Continuing	
	d. Development of diagnostic X-Ray techniques which minimize exposure of humans to radiation.	ONR Aerospace Med. Center	Ohio State University	Continuing	

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CATEGORY OF RADIATION RESEARCH	DESCRIPTION OF PROGRAM	SUPERVISING AGENCY	LOCATIONS	DURATION	SIGNIFICANCE
8. Detection and Measurement	a. Sensitive whole-body radiation counters and phantoms or models as aids in precisely calibrating, measuring, and detecting radiations from different sources must be developed as tools for interpreting field data and laboratory experiments.	Chemical Corps	Chemical Corps Laboratory QM Food and Container Institute Chemical Proving Grounds, Dugway	Continuing	The need for accurate means for measuring radiation in order to relate effects observed to the intensity of the causal agent is apparent. Better techniques and instruments are needed.
		BuMed	Naval Medical Research Contracts and Randolph Field		
		Aerospace Medical Center			
9. Education, Training, and information	a. The Army maintains schools offering training in radiation hazards, use of isotopes and sources for diagnosis and therapy, and information about new developments in radiobiology. In addition qualified military personnel attend Universities and Institutes for advanced education in this subject. General information on radiation has been incorporated into basic training.	Headquarters, Department of the Army	Walter Reed Army Institute of Research	Continuing	Proper training to meet anticipated military situations has always been a primary responsibility of the Armed Services. Military aspects of radiation biology have been integrated into the training program at all levels.
			Army Hospitals		
			U. of Rochester		
		Continental Army Command	Reed College		
			Chemical Corps School		
			Basic Training Post		
		BuMed	U.S. Naval Med. School		
			Nat'l Naval Med. Center		
			Naval Hospitals		
			Naval Schools Command		
		Air Training Command	Aerospace Medical Center		