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PROPOSED BUDGET FY 1954

Radiological Laboratory - Contract AT-11-1-GEN-10, Project No. 2
University of California Medical Center
San Francisco, California

SECTION	SALARIES	SUPPLIES + EXPENSE	EQUIPMENT
ADMINISTRATIVE			
General Expenses	$ 22,002.00	$ 7,500.00	$ 2,350.00
Travel and Removal Expenses		4,000.00	
Abnormal use of Utilities		1,000.00	
General Assistance	5,000.00[1]		
PHYSICS	27,624.00	16,000.00	9,580.00
BIOLOGY	54,470.00	19,230.00	7,070.00
HEMATOLOGY	10,488.00	2,100.00	---
CLINICAL	11,328.00	4,000.00	1,000.00
RADIOIODINE	12,263.00	6,250.00	---
TOTALS	$143,175.00	$ 60,080.00	$ 20,000.00

BUDGET RECAPITULATION

Supplies and Expense	$ 60,080.00
Salaries	143,175.00
SERS, 8.11 % + $5.25 per person	9,439.00
Compensation Insurance, S + T, 0.85%	1,071.00
Compensation Insurance, NT, 0.04%	68.00
Overhead, 25% of Salaries	
TOTAL OPERATING BUDGET	$249,627.00
Equipment	20,000.00
TOTAL BUDGET REQUEST	$269,627.00

[1] General Assistance. Contains provisions for vacation-replacements, part-time help, and terminal - leave payments.

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ESTIMATED MAN-YEARS FY 1954

SECTION	SCIENTIFIC	TECHNICAL	NON-TECHNICAL	SALARIES
ADMINISTRATIVE - Robert S. Stone, M.D.				
Director	0.2			$ 4,920.00
Business Manager I			1.0	5,772.00
Secretary (Medical)			1.0	3,216.00
Sr. Account Clerk			1.0	3,132.00
Editor II			0.5	2,046.00
Secretary Stenographer			1.0	2,916.00
PHYSICS - Gail D. Adams, Ph.D.				
Research Physicist I	1.0			9,156.00
Jr. Research Physicist II	1.0			5,100.00
Grad. Research Physicist I	1.0			3,288.00
Sr. Accelerator Technician		1.0		4,980.00
Sr. Laboratory Mechanician		1.0		5,100.00
BIOLOGY - Henry I. Kohn, M.D.				
Research Biologist	1.0			12,000.00
Asst. Research Biologist I	1.0			5,628.00
Asst. Research Physiologist I	1.0			5,628.00
Asst. Research Pathologist II	1.0			5,916.00
Sr. Laboratory Technician		1.0		4,092.00
Sr. Laboratory Technician		1.0		3,900.00
Sr. Laboratory Technician		1.0		3,720.00
Laboratory Technician		1.0		3,542.00
Laboratory Technician		1.0		3,372.00
Laboratory Technician		1.0		3,216.00
Animal Caretaker		1.0		3,456.00
HEMATOLOGY - Paul M. Aggeler, M.D.				
Consultant Hematologist	0.2			2,652.00
Sr. Laboratory Technician	1.0			4,620.00
Laboratory Technician		1.0		3,216.00
CLINICAL - Robert S. Stone, M.D.				
Professor of Radiology	0.2			-
Jr. Research Radiologist	1.0			4,740.00
Staff Nurse		1.0		3,216.00
Sr. X-ray Technician		1.0		3,372.00
RADIOIODINE - Earl R. Miller, M.D.				
Professor of Radiology	0.2			3,941.00
Consultant Physician	0.1			1,000.00
Jr. Research Radiologist	0.75			3,600.00
Sr. Laboratory Technician		1.0		3,722.00
TOTALS	10.65	13.0	4.5	$138,175.00

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UNIVERSITY CONTRIBUTION TO
THE RADIOLOGICAL LABORATORY PROGRAM

The University of California, through the School of Medicine at San Francisco, is seeking financial assistance for the operation of the Radiological Laboratory from the Atomic Energy Commission, which has built and equipped this Laboratory. It is well, at this time, to point out that whereas the Atomic Energy Commission is providing the main financial assistance for the additional work being done by the Radiological Laboratory, the University through its own personnel and equipment and facilities is contributing a great deal toward this project. Many of the scientific personnel would not be here were it not for the connection with the University which they enjoy here. Thus, we are able to procure a good group of scientists.

The aim of this project is eventually to improve the therapeutic application of radiations in the treatment of cancer. In order to have patients on whom to try the new types of radiations and the new techniques that will be developed, it is necessary to have a connection with the University of California Hospital and Outpatient Department. It is necessary to have a complete staff of medical men in the Hospital and Outpatient Department to screen the patients so as to obtain those that are most likely to be benefited by the new treatments; and it is necessary to have all of the facilities of a university clinic and hospital to properly study these patients.

It is impossible to put a monetary value on the contribution of the University's personnel, facilities, etc. Suffice it to say that without the University connection, a project such as this could not operate.

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PROGRAM FOR 1953 - 1954

RADIOLOGICAL LABORATORY
UNIVERSITY OF CALIFORNIA SCHOOL OF MEDICINE
SAN FRANCISCO

Contract AT-11-1-GEN-10, Project No. 2

Robert S. Stone, M. D., Director
Gail D. Adams, Jr., Ph.D., Associate Director

GENERAL

The program for fiscal year 1953-54 will include full use of the new building and facilities for the first time. The building was accepted in September 1951, and the synchrotron in July 1952. The synchrotron has needed numerous alterations to make it usable for our purposes. To hasten this process we have asked for an expansion of the Physics Section staff. The Biology Section has standardized certain tests on the 250 kilovolt x-ray machine to be used later for comparisons with the radiations from the 70 million volt synchrotron. These tests can proceed as rapidly as the synchrotron operation will permit. The application of the multimillion volt radiations to patients with cancer should get underway in fiscal year 1953-54. The radioiodine program will decrease considerably, and the original hematology program has been terminated except for following a few patients.

For administrative and research purposes the Laboratory is divided into sections. The Administrative Section will handle those matters generally taken care of in a business office, as well as providing clerical and editorial help for all sections.

PHYSICS SECTION - Gail D. Adams, Jr., Ph.D., in charge.

The Physics Section was created primarily for the physical evaluation of the radiations which the 70 million electron volt synchrotron produces and for the operation and maintenance of the instrument. Although 70 Mev x-rays were first produced by this machine in San Francisco on November 9, 1951. field tests and necessary development work not completed at the factory resulted in delaying acceptance until July 1, 1952. Shortly after acceptance a large but preliminary program of irradiation of biological specimens was instituted simultaneously with physical studies of the x-ray beam. Then followed another development period aimed at increasing the utility and flexibility of the synchrotron. After another calibration period, a major series of biological irradiations was again made. It is hoped that these will be definitive.

Dosimetry is the chief responsibility of the Physics Section: radiations included are 250 Kv x-rays, 70 Mev x-rays, and electrons from perhaps 5 to 70 Mev. Dosage intercomparisons are to be made between ionization and absolute energy units. In the case of 70 Mev x-rays, an independent comparison of these units with induced radioactivity should be made. It is anticipated that much of this will have been done before treatment of human patients with cancer will have been started. Toward

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PHYSICS SECTION (Continued)

the end of fiscal year 1953-54, it is expected that the electron extraction equipment will be installed on the synchrotron. When this installation has been completed, the physics section will start a series of experiments designed to evaluate the electron beam and to control this beam and to control this beam in a way which will make it usable clinically.

Since much more extensive modification of the synchrotron is necessary than was originally planned, and since the instrumentation for measurement of the beam is proving a bigger problem than was originally contemplated, a larger Physics Section staff is planned in order to speed up the work.

BIOLOGY SECTION - Henry I. Kohn, Ph.D., M.D., in charge.

During fiscal year 1952-53 the Biology Section has become a functional unit and has developed almost full scale operations. The plan for fiscal year 1953-54 is to continue the work begun in the past year and to expand into the field of experimental pathology. The major problem of the section is to determine the effectiveness of 70 Mev x-rays relative to 250 Kv x-rays. The determination of the biologically equivalent doses of these rays will pave the way for the clinical use of the synchrotron. A variety of experiments for this purpose have been devised and tested with 250 Kv x-rays. Some tests were run on the synchrotron but cannot be fully interpreted until the physical calibration of the new instrument is completed. It is currently expected that further tests will begin in the last part of the present fiscal year and will continue as a major part of the program in FY 1953-54. Tests involving immediate, delayed, and late reactions will be made by measuring the dose necessary to kill 50 percent of the animals in a given period of time, including mice, rats, 4-day old chick embryos, and several species of microorganisms; to produce changes in the weight of the testis, thymus, and spleen of mice; to produce a definite reaction in the skin and change in growth rate of the tail of the rat; to produce a definite effect by local irradiation on tumors in hamsters; and to induce tumors in mice. Similar tests will be used later to determine the relative biological effectiveness of multimillion volt electrons.

The second major objective of this program is the study of the effect of varying the distribution of a given dose of radiation in time. Contemporary radiation therapy depends largely upon the fractionation and protraction of dosage to bring out the differential sensitivity of normal tissues and neoplasms, but methods of doing this have not been studied very extensively in any biological laboratory. During the present year a systematic study has been initiated investigating the effects of fractionation and protraction upon the radiation reactions of the testis and thymus, and it is planned to extend this study to skin and bone and to at least one transplantable animal tumor during FY 1953-54. The experiments employ localized rather than total body irradiation, and thus mimic the conditions of radiotherapeutic practice. The synchrotron will be employed here as well as the conventional 250 Kv machine.

The third major portion of the Biology Section program is the relation

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BIOLOGY SECTION (Continued)

between radiation sensitivity and the metabolic state of the cell. The metabolic state of the cell is in turn dependent upon its environment. For this purpose it was decided to employ microorganisms in "model" experiments, which are far more economical than analagous animal experiments. Six metabolically different types of microorganisms have been selected, and the conditions for their maintenance and experimental use determined. A comparative study of their reactions to 70 Mev and 250 Kv x-rays in different types of standardized media will begin in the latter half of this fiscal year and continue in FY 1953-54. It is hoped that the results will provide basic knowledge for understanding radiation reactions in general, and specific suggestions for means of increasing the differential sensitivity between normal tissues and neoplasms.

The histopathological study of the tissues exposed to the varying radiations is a very important part of the work. To cover this, the program for next year includes the employment of a pathologist and the necessary technical help. The pathologist will be primarily interested in histochemical methods of detecting differential changes in various tissues.

CLINICAL SECTION - Robert S. Stone, M.D., in charge.

It is hoped that the physical and biological tests on the synchrotron will be far enough advanced to justify treating some patients with cancer on the synchrotron late in 1952-53 and a larger number of patients in 1953-54. When such treatments get under way, the hematologists and pathologists will cooperate with the clinicians to study the effects of the multimillion volt radiations.

HEMATOLOGY SECTION - Paul M. Aggeler, M.D., in charge.

The staff of this section are still trying to get a practical means of counting blood platelets. They can be seen so clearly and identified so easily with phase contrast lighting and an oil immersion lens (1000 X), but the problem has been and still is to get the hemocytometer manufacturers to make the right kind of chamber. When the "ideal" method of counting platelets is worked out, a comparison will be made between this method and all other methods as a means of determining their accuracy. The fragility of blood platelets before and after roentgen irradiation, and in health and disease is to be tested by studying the effects of ultrasonic vibration. This study has been delayed pending the development of an accurate method of counting whole and fragmented platelets. Other problems to be investigated by this section are (1) the leukocyte response to irradiation of localized areas of the body (animals and patients); (2) the effect on the blood and hemopoietic tissue of the large doses of radioiodine given to cancer patients, and the recovery from such effects; (3) the relative effect of 250 Kv and 70 Mev radiations on the blood of animals and patients; and (4) the effect of intravenously administered soybean phospholipid in restoring the normal prothrombin consumption in thrombocytopenic subjects.

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RADIOIODINE SECTION - Earl R. Miller, M.D., in charge.

The major emphasis of this section for fiscal year 1953-54 will be placed on studying methods of increasing the uptake of radioiodine in cancers of the thyroid gland and their metastases. The usefulness of Thyroid Stimulating Hormone (TSH) for this purpose will be more thoroughly evaluated. In order to better localize the areas of uptake of radioiodine, further studies will be made on the design and use of multichannel cones and other instruments. Since 1945 a series of patients have been examined and treated for hyperthyroidism by Dr. Miller and his assistants. These are probably the most thoroughly investigated and carefully followed patients that have been treated with radioiodine anywhere. It is planned to continue to follow these patients for a few years, but no new patients will be given tests for or treatment of hyperthyroidism with radioiodine on this research project. There are still a few physiological problems to be settled, such as the rapidity with which the thyroids of patients recover from the influence of drugs that alter the iodine metabolism. The extent of the program of the Radioiodine Section will continue to decrease during 1953-54.

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