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THE RADIOLOGICAL LABORATORY

UNIVERSITY OF CALIFORNIA SCHOOL OF MEDICINE

SAN FRANCISCO

Operating under

Contract AT-11-1-GEN-10, Project No. 2
with the Atomic Energy Commission.

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

Proposed Budget and Program, FY 1955-1956

I. Brief Description of Proposed Work

The main purpose of this Laboratory is to investigate the usefulness of the 70 million volt synchrotron as a medical tool and to improve the efficiency of the radiation treatment of cancer by the use of this instrument or by any other means that may be discovered. In order to attain this purpose, animal studies precede clinical applications. A secondary program is a study of methods of treatment of cancer of the thyroid with radioiodine.

This project is listed by the Atomic Energy Commission as one of the "research and development installations of the U.S. Atomic Energy Commission". It is housed in the Radiological Laboratory Building on the San Francisco Campus. The building with its equipment was financed by the Atomic Energy Commission and the program within the building is supported almost entirely by the Atomic Energy Commission. The presently active contract for the operation of this Laboratory was initiated in 1949. The prior work under other related contracts was started in 1952.

II. Reasons for the Government's Interest

The Atomic Energy Act makes the Atomic Energy Commission responsible for investigating the biological effects of ionizing radiation, including the effect on cancer. Congress has appropriated funds and allocated them to the Atomic Energy Commission for such work from year to year. The Atomic Energy Commission is discharging its responsibilities through contracts with national laboratories, university laboratories, etc. It has selected the University of California School of Medicine, San Francisco, as the place where methods of radiation therapy can be studied with special emphasis on the radiations from the 70 million volt synchrotron, and it has allowed us to continue on a diminishing basis the studies on the use of radioiodine in thyroid diseases and the effects of total-body irradiation on the blood of patients.

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PROPOSED BUDGET FY 55-56

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

SECTION	EQUIPMENT	SUPPLIES AND EXPENSE	SALARIES
DIRECTOR'S OFFICE			$ 6,750.00
ADMINISTRATIVE	$ 1,500.00	$ 7,000.00	$ 14,418.00
General Assistance[1]			8,443.33
Travel and Removal Expenses		4,000.00	
PHYSICS	7,000.00	26,000.00	35,152.80
BIOLOGY	2,500.00	12,000.00	43,296.00
PATHOLOGY AND HEMATOLOGY		2,000.00	15,352.00
CLINICAL	4,000.00	4,000.00	13,596.00
RADIOIODINE		900.00	1,712.50
TOTALS	15,000.00	55,900.00	138,720.63

CATEGORIES	AMOUNTS	TOTALS
Equipment	$ 15,000.00	
Supplies	55,900.00	
Salaries	138,720.63	
SERS, 8.17% plus 5.25 per person	10,672.16	
Compensation Insurance (Sc. and Tech. .73 per hundred)	858.36	
Compensation Insurance (Non-Tech. .05 per hundred)	8.81	
Sub-total		$ 221,159.96
Overhead, 28% of total salaries and wages		
		$ 260,000.00
Research Bed Fund[2]	55,000.00	55,000.00
TOTAL BUDGET REQUEST		$ 315,000.00

[1]General Assistance. Contains provisions for vacation relief, replacement over-lap, part-time help, terminal leave payments, and provisions for a probable cost-of-living increase.

[2]Research Bed Fund listed separately for special negotiation.

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THE RADIOLOGICAL LABORATORY PROJECT

Estimated Man-Years FY 55-56

SECTION	NAME	SCIENTIFIC	TECHNICAL	NON-TECHNICAL
DIRECTOR'S OFFICE				
Director	Robert S. Stone, M.D. (See Clinical)	0.25		
Associate Director	Gail D. Adams, Ph.D. (See Physics)			
ADMINISTRATIVE				
Administrative Assistant	Conrad M. Sue, B.B.A.			1.0
Senior Account Clerk	Roland N. Warner			1.0
Editor II	Ruth M. Hassler, M.A.			1.0
Secretary-Stenographer	Margarita Wintroath			1.0
PHYSICS				
Research Physicist - In charge	Gail D. Adams, Ph.D.	1.0		
Junior Research Physicist II	David L. Dye, Ph.D.	1.0		
Graduate Research Physicist I	Helen E. Jones, B.S.	1.0		
Graduate Research Engineer I	John L. Radsliff, B.S.	0.9		
Senior Laboratory Mechanician	Henry D. Steier		1.0	
Senior Accelerator Technician	Seymour Winston		1.0	
BIOLOGY				
Research Radiologist - In charge	Henry I. Kohn, Ph.D., M.D.	1.0		
Assistant Research Biologist	Shirley E. Gunter, Ph.D.	1.0		
Assistant Research Physiologist	Robert F. Kallman, Ph.D.	1.0		
Senior Laboratory Technician	Janet J. Henderson, B.A.		1.0	
Senior Laboratory Technician	Vernon E. Wilder, B.S.		1.0	
Laboratory Technician	Mary B. Brown, B.A.		1.0	
Animal Caretaker	Walter Hicks		1.0	
Laboratory Helper	Margaret R. Leonard		1.0	

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THE RADIOLOGICAL LABORATORY PROJECT

Estimated Man-Years FY 55-56

SECTION	NAME	SCIENTIFIC	TECHNICAL	NON-TECHNICAL
PATHOLOGY AND HEMATOLOGY				
Assistant Research Pathologist	Charles C. Berdjis, M.D.	1.0		
Assistant Research Hematologist	Nicholas L. Petrakis, M.D.	0.1		
Senior Laboratory Technician	Patricia L. Pickett, B.A.		1.0	
Senior Laboratory Technician	Bonnie D. Ploeger, B.A.		1.0	
CLINICAL				
Professor of Radiology - In charge	Robert S. Stone, M.D.			
Assistant Research Radiologist	------			
Staff Nurse-Technician	------			
Medical Secretary	------			
RADIOIODINE				
Professor of Radiology - In charge	B.V.A. Low-Beer, M.D.	0.1		
Consulting Physician	Morris E. Dailey, M.D.	0.1		
	TOTALS	8.45	10.0	5.0

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THE RADIOLOGICAL LABORATORY

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Operating under

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Robert S. Stone, M.D., Director
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Scientific Program for 1955 - 1956

GENERAL

The Radiological Laboratory has been established to investigate some methods for improving the radiation treatment of cancer. A 70 Mev synchrotron has been installed and the evaluation of the radiations obtainable from this instrument is the first order of business for the Laboratory. Although advertised by the manufacturer, the General Electric Company, as a "medical" device, the synchrotron has been undergoing development by us during the last three years so that it will be useful for medical purposes. We have also learned recently that the General Electric Company is likely to abandon all aspects of its synchrotron business, thus precluding the possibility of obtaining any non-standard replacement parts in the future. The whole operation to date has been considerably less than satisfactory. On the brighter side, the development of the synchrotron appears to be near completion. A study in reliability of operation over substantial periods of time is in progress. If the desired reliability is achieved, the biological and subsequent clinical work with the synchrotron can begin in short order.

The unavailability of certain critical parts which are specially designed for the synchrotron has forced the Laboratory to divert time and funds towards assurance of a future supply. This program operates in parallel with the main line of attack, requiring synchrotron time very seldom, and then only to assess net gain.

The program proposed last year under the assumption of an operating synchrotron obviously could not be accomplished and must be repeated as part of the proposal for next year. A fair amount of work which did not require use of the synchrotron has been completed. The actual time lapse between the end of synchrotron developments and the start of clinical work should be minimal.

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

The work for which the synchrotron was intended should be well started before the close of the present fiscal year. The program of this section will, therefore, be largely one of cooperation with other sections, and the specific items are segregated accordingly.

1. The first task of the Physics Section is to provide accurate physical measurements so that the Biology Section can make a comparison of 70 Mv with 250 kv constant potential x-rays, using various biological end-points. This comparison is necessary as a basis for approximating quantities of 70 Mv x-radiation to be used in cancer treatments, there being considerable experience in the case of 250 kvcp x-rays. For this comparison, the measurment of quantity must be in reproducible units, although the units need be neither absolute nor the same for the two radiation qualities. It is expected that investigations using biological end-points will continue part-time after cancer treatments begin.

2. When the biological calibration of the 70 Mv x-rays has been made, cancer treatments will be started by the Clinical Section. Whereas the irradiation of biological specimens will generally use the largest x-ray field readily obtainable, the plans to be developed for specific treatment schedules will undoubtedly use fields of various sizes and shapes. Manufacture and evaluation of proper devices to produce these fields will be necessary. The units of measurement of quantity may remain arbitrary for a short time, but the measurement in absolute units must be done. An attempt at the absolute calibration will be made before any cancer treatments are started. A neutron survey will be made including estimation of the neutron dose to be received by a patient during a typical treatment.

Since treatment schedules will extend over several weeks for any patient, the synchrotron must be operable every day. At the present time, whenever a vacuum failure occurs, the synchrotron is inoperable for several days. To improve this situation, the development of a new vacuum system now under way and the production of a quantity of vacuum tubes in our Laboratory will be completed. A manufacturer will be sought to take over the fabrication of sealed-off vacuum tubes. With sealed-off tubes, the synchrotron would be shut down for a minimum time due to vacuum failure of any kind.

3. There are a number of developments which are all aimed at improving the certainty of the dosimetry (measurement of quantity of x-radiation and of the absorption of energy by tissue from this quantity) which are contemplated. Among these are:

a. Completion of an automatic exposure control device.

b. Completion of a method for minimizing or eliminating the effect of the conductivity which appears in insulators when irradiated.

c. Further measurements on the actual conductivity changes in controlled cases, since the elimination method under development cannot be applied to many standard instruments.

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d. The vacuum calorimeter will be employed to measure total energy content in radiation beams of various qualities and energy absorption properties of some materials in some cases.

e. Some vacuum tube development work aimed at the production of x-ray pulses of variable time width will be done. Pulse width may be important in determining the effectiveness of a given quantity of radiation in the production of a specific biological change.

f. A body of information will be assembled pertaining to the association between x-ray intensity and the dose-rate absorbed by tissues from such intensity.

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

The work anticipated for fiscal year 1955-56 in the Biology Section will be largely a continuation of the work now in progress.

The synchrotron may be available for the last few months of 1954-55 to start the biological calibration of the 70 Mv x-ray beam, but the major portion of this work will undoubtedly be done during fiscal year 1955-56. The various tests planned, which will examine the acute, delayed, and late reactions, have already been worked out in detail and standardized on the 250 kv machine so that the comparisons, when using the synchrotron, should be readily accomplished.

As time permits, studies will be continued with the object of determining how fractionation of the total dose of x-rays influences the radiation reaction of various normal and neoplastic tissues and organs. The relation of the findings to the effects of fractionating whole-body irradiation is being studied. We also intend to study the influence of certain drugs on the reaction to x-rays in the hope that some drug may be found which will vary the response of the tissues or organs to varying methods of dividing the doses of x-rays. These studies are all aimed at improving the results of the radiation therapy of cancer.

The comparative study of the relation between radiation sensitivity and the metabolic state, using five different microorganisms, will be continued. It is anticipated that emphasis will be placed upon those changes which occur when growth is initiated. This program is expected to provide both a means of studying the effects of 70 Mv x-rays as compared with 250 kv x-rays and to provide a better understanding of the mechanism of action of x-rays on living material.

HEMATOLOGY AND PATHOLOGY SECTION — Nicholas L. Petrakis, M.D., in charge of Hematology. Charles C. Berdjis, M.D., in charge of Pathology.

Our special studies on platelet counting and on the effects of total-body irradiation on the blood of man will have been completed before the end

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of fiscal year 1954-55. In fiscal year 1955-56 we anticipate that the hematological work will be mainly cooperative work with the Biology and Clinical Sections. Dr. Petrakis has succeeded Dr. Paul M. Aggeler as the academic person in charge of the hematological work.

Dr. Charles C. Berdjis, a well trained pathologist, has recently joined our staff on a full-time basis. He will take an active part by studying the histological changes in the tissues that have been and will be irradiated under the programs of the biological and clinical sections.

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

Because the synchrotron has not yet performed with sufficient reliability to justify starting the treatment of patients with cancer, the Clinical Section has not yet gone into action. Present indications are that we will start treating patients before the end of fiscal year 1954-55, and certainly during 1955-56 we should be able to treat a considerable number of patients. The patients to be treated will be selected from those referred to the Radiation Therapy Division of the University of California Hospitals. The plan is to start treating patients who have relatively far advanced lesions and, as experience accumulates, proceed to the treatment of patients with more and more localized disease.

In order to properly manage and observe patients who are under treatment, it is frequently necessary to hospitalize them. This is more important for patients who are part of a research project and therefore may be hospitalized for the benefit of the study rather than for their own. The "hospitalization" funds that are being requested in the FY 1955-56 budget will be used, if granted, to pay for the hospitalization of patients when such hospital care is needed for the benefit of the research studies and to pay for such laboratory and x-ray consultations as are needed.

RADIOIODINE SECTION — B. V. A. Low-Beer, M.D., in charge.

During fiscal year 1955-56 the work of the Radioiodine Section will consist of continuing to follow patients who have previously been treated with radioiodine to look for either any late effects of the radioiodine or recurrences of their disease. The patients followed will be all of those who have had cancer of the thyroid and the first 175 patients who were treated for hyperthyroidism. If any new patients with cancer of the thyroid present themselves who show by their radioiodine uptake studies that they might profit by treatment with massive doses of radioiodine, such treatment will be undertaken.

Dr. B. V. A. Low-Beer will replace Dr. Earl R. Miller as the responsible investigator in this section.

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