Annual Report
July 1, 1950

BROOKHAVEN NATIONAL LABORATORY

Associated Universities, Inc.
Upton, New York

This report, submitted under the terms of Contract #AT-30-2-GEN-16, between Associated Universities, Inc. and the Atomic Energy Commission, covers the interval July 1, 1949 - June 30, 1950. It is the first annual report, and it covers the entire progress of the Laboratory. However, since a report (BNL 39 (AS-3)) was issued for the period July 1 - December 31, 1949, this report is, for the most part, a review of work done during the first half of 1950. It contains both a summary of research in progress at Brookhaven National Laboratory and an outline of the Laboratory's future program.

Printed at Upton, New York, for distribution to persons and organizations associated with the national atomic energy program.

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PART ONE

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Introduction

The purpose of this introductory section is to record the subjects to which the Trustees, their committees, and the Officers of Associated Universities, Inc. have given particular attention during the past six months. The second part of this report will provide a full account of the progress of Brookhaven National Laboratory during the period and its plans for the future.

As in the past, the Trustees have maintained their lively and direct interest in all of the affairs of the Laboratory, and have substantially assisted its management through funneling their institutions' intellectual resources into the project.

At regular monthly meetings of the Executive Committee and quarterly meetings of the Board of Trustees, detailed reports of the Officers and Director have been considered and acted upon. The value of their knowledge of the Laboratory's work and their guidance on major matters of policy and procedure have been augmented by visits of individual trustees to Brookhaven National Laboratory, by service on special committees, and by conferences at their respective universities with the Director and Officers. Of great importance, also, is the perspective which they bring to those engaged closely in the daily operation of the Laboratory.

Trustees Report

In July, 1949, the Trustees authorized a committee to prepare a report summarizing and appraising the experience of AUI as a contractor with the AEC during the first three years of the contract relationship. The report was submitted in April. It found that steady progress was being made toward realization of the fundamental purposes of the participating universities, and that, on the whole, the contractual relationship with the AEC was satisfactory, the exceptions being matters of procedure more than of principle. In the report itself, and in subsequent considerations of major policies, the Trustees expressed their judgment on several important matters.

1. It is the wish of AUI to provide an environment in which promising fundamental research can flourish, but also to render service to the country by undertaking other projects of immediate practical value to the Commission's other programs. Fundamental research is the foundation upon which future scientific development rests. In the national interest and for the good of science, the Laboratory's role as a center for fundamental nuclear research and development must be protected. Also in the national interest, however, problems of immediate practical concern must be solved. To the extent consistent with its primary purpose, Brookhaven National Laboratory should seek ways in which to assist the AEC in solving them. Therefore, in light of the increasingly grave international situation, the Trustees concurred in the plan of the Director of the Laboratory to explore with the AEC ways in which the Laboratory can now be especially useful in the national interest.

2. Without relaxing the effort to recruit a first-class staff and initiate fruitful programs of research, primary operating emphasis should be given to the earliest possible completion of major facilities.

3. The resources of equipment and staff at the Laboratory are intended to be used in cooperative projects and in training by qualified scholars or engineers from any educational or research institution in the northeastern area.

Contract Negotiation

The Corporation's contract with the Atomic Energy Commission provides for expiration on December 31, 1950, unless renewed. Early completion of negotiations

for renewal is desirable. The President appointed a committee of Trustees to assist the Officers of the Corporation in negotiating renewal of the contract with the AEC. During July, the contract was extended for six months to June 30, 1951, in order to bring its term into conformity with the AEC's fiscal year, and to provide more time for discussion of certain features to be embodied in the new contract. This committee, with some of the Officers and the Laboratory Director, has met with a group of representatives of the AEC in a preliminary discussion of some aspects of the contractual relationship. Thereafter, the Trustees reaffirmed their view that the best interests of the AEC and of the universities will be served by preserving a substantial measure of administrative autonomy in AUI as the representative for the universities.

Organization and Personnel

Dr. George B. Collins, representing the University of Rochester, resigned from the Board of Trustees to assume his new post as Chairman of the Accelerator Project at the Laboratory. At its April meeting, the Board elected Dr. William S. McCann of the Rochester School of Medicine and Dentistry to take Dr. Collins' place.

Meetings of the Visiting Committees

The following meetings of the visiting committees were held between January 1 and June 30, 1950:

For the Biology Department:

April 22, 1950. To review the current and future program of the Biology Department, and to consider the choice of a new Department Chairman. The committee approved Dr. Howard Curtis, who will assume this post on October 1.

For the Chemistry Department:

June 29-30, 1950. To review and appraise the work of the Chemistry Department. In its report, the committee was most complimentary about the Department's work, staff, and leadership, and emphasized the importance of postdoctoral fellowships as a means of training nuclear scientists.

For the Medical Department:

April 6-7, 1950. To review the Medical Department's program and to become better acquainted with its staff. The committee found that a splendid start has been made in gathering a well-qualified staff, and in beginning an important research program. The committee's findings emphasized the desirability of bringing the Medical Department into closer touch with other scientific departments, particularly the Biology and Physics Departments, as soon as possible, and the importance of avoiding delay in building permanent hospital facilities for medical research at the Laboratory.

Administration of AEC Predoctoral Fellowships

Acting upon the request of the AEC, and as an emergency measure, Associated Universities, Inc. undertook administration of the AEC Predoctoral Fellowships in the northeastern region for the academic year 1950-51. Although the announcement of the fellowships was unusually late, 142 completed applications were received from students seeking to undertake advanced study in the physical and life sciences. After careful review of their academic qualifications by Fellowship Panels, and "fellowship approval" by AEC, as required by law, 37 appointments were made by Associated Universities, Inc. and accepted. These men will study toward advanced degrees in 15 universities in the northeastern area.

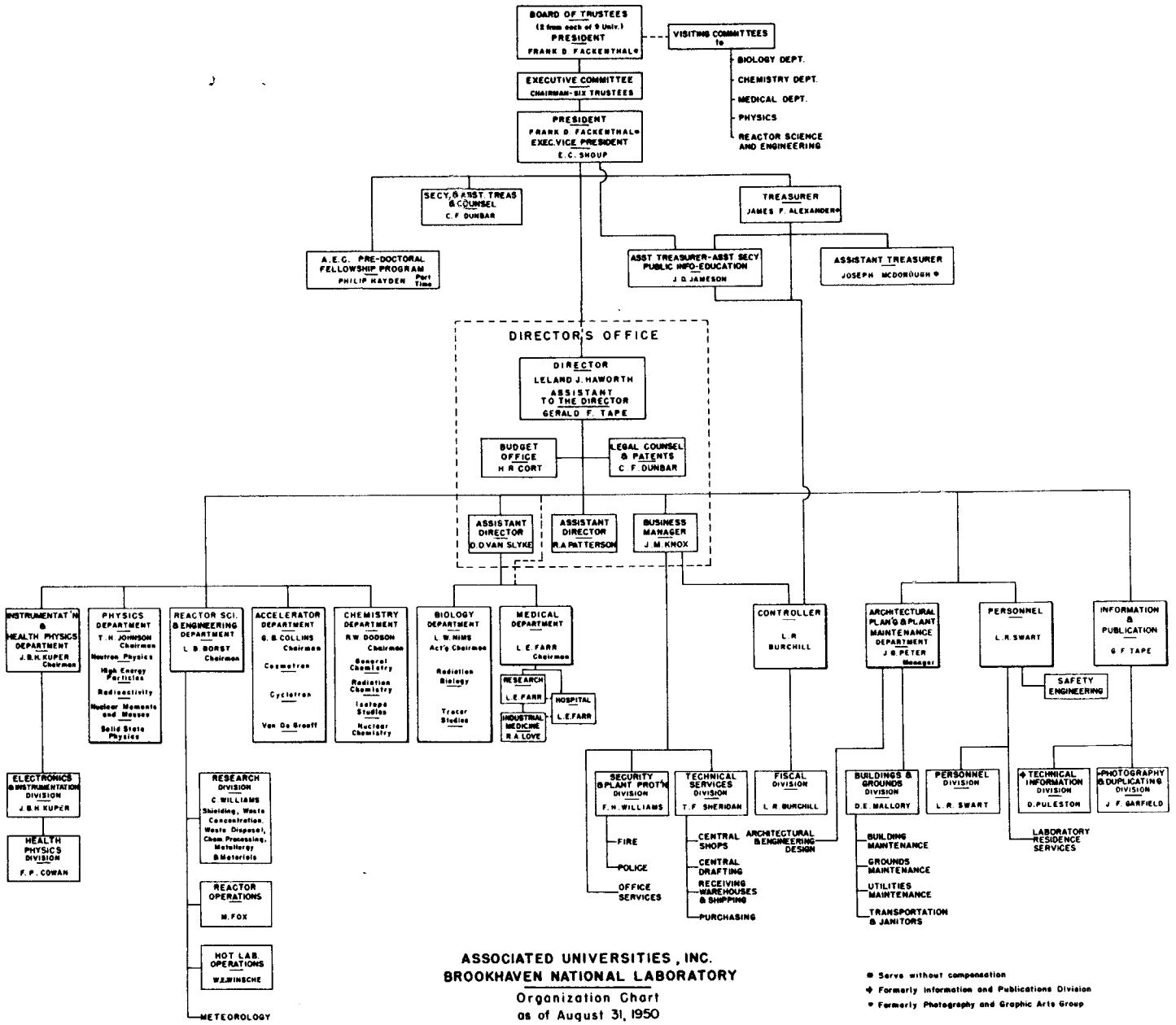
Invaluable assistance was received from the National Research Council in establishing administrative procedures and in examining and ranking the qualifications of applicants. AUI also acknowledges with sincere thanks the service of the members of the AUI Fellowship Panels:

Physical Sciences

Dr. T.B. Drew, Executive Officer, Department of Chemical Engineering, Columbia University
Dr. R.W. Dodson, Chairman, Chemistry Department, Brookhaven National Laboratory
Dr. J.C. Boyce, Chairman, Department of Physics, New York University

Biological Sciences

Dr. D.D. Van Slyke, Assistant Director, Brookhaven National Laboratory
Dr. H.H. Rossi, Assistant Professor of Radiology, Columbia University
Dr. L.F. Nims, Chairman, Biology Department, Brookhaven National Laboratory



ASSOCIATED UNIVERSITIES, INC.
BROOKHAVEN NATIONAL LABORATORY
Organization Chart
as of August 31, 1950

* Serve without compensation
✣ Formerly Information and Publications Division
* Formerly Photography and Graphic Arts Group

PART TWO

REPORT OF BROOKHAVEN NATIONAL LABORATORY

INTRODUCTION

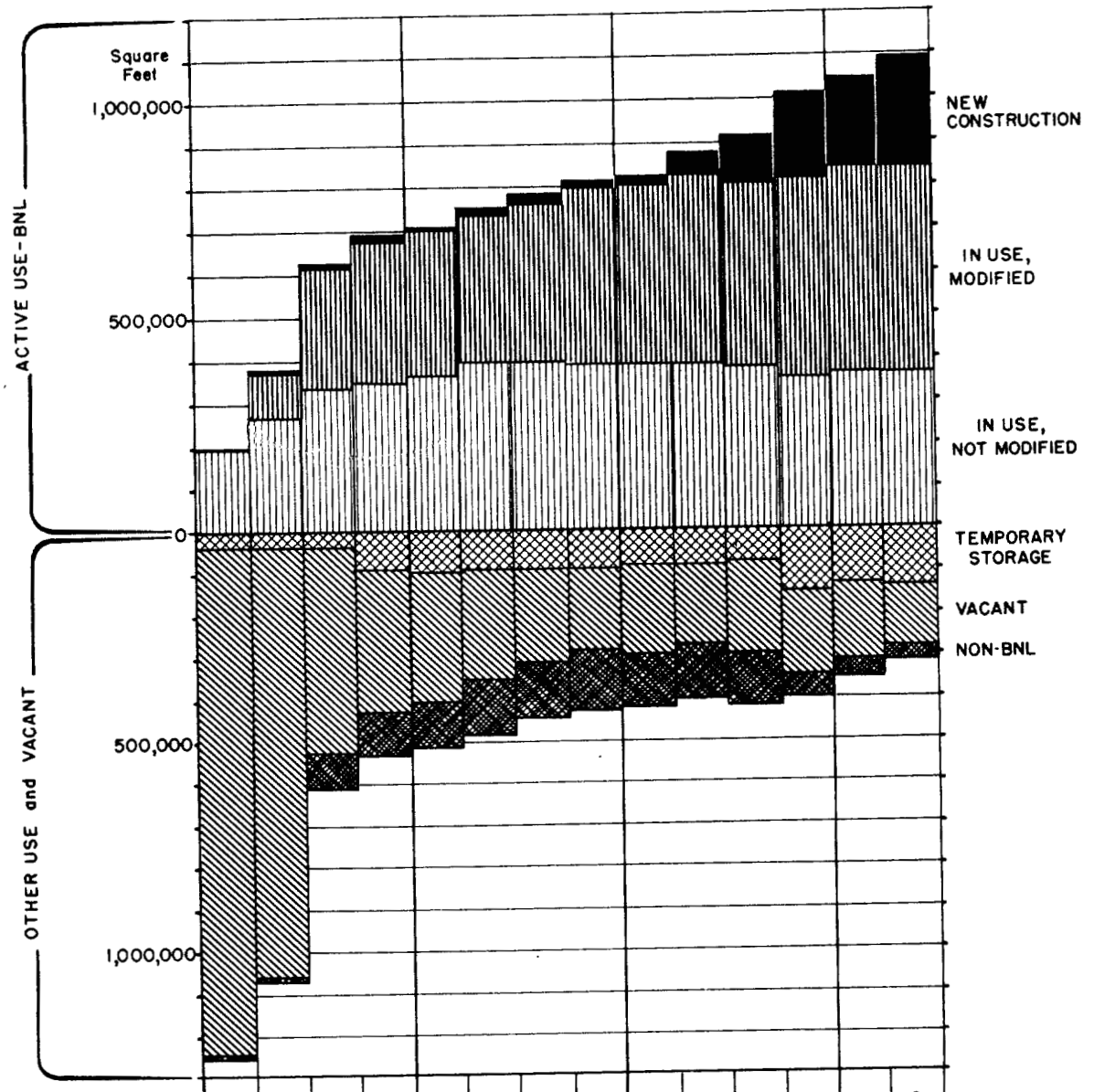
This report for fiscal year 1950 concentrates on the work of the last half of the year, since a semiannual report was issued on December 31, 1949 (BNL 39 (AS-3)). With the adoption of the new procedure of issuing an annual report at the end of the fiscal year, this report of an interim nature emphasizes the scientific research progress of the past six months and reviews the administrative aspects of Laboratory operation for the entire fiscal year. For detailed reports on the research progress of the various scientific departments, attention is called to the quarterly scientific progress reports of the Laboratory.

July 1950 saw the completion or near completion of many of the initial facilities planned for Brookhaven National Laboratory. The reactor complex was complete, except for the reactor alterations; these were scheduled for August completion. The Accelerator Project realized the completion of the cyclotron - Van de Graaff building and the installation of the two machines. The Cosmotron building was completed. The fabrication of components and their assembly into the Cosmotron continued.

The greatest effort toward the completion of facilities was spent on the nuclear reactor. This maximum of effort plus the diversion of considerable funds made possible the virtual completion of the reactor in August. It is to be noted, parenthetically, that the alterations were completed by the H.K. Ferguson Company on August 11, 1950, at which time the reactor was turned over to the Laboratory. Loading of the uranium proceeded until criticality was reached on August 22, 1950.

The first phase of the Biology building was completed and put into active use. The Chemistry complex was completed, with the exception of part of one wing which will be finished in 1951. The Physics Department, although scattered through many temporary buildings, carried its work through to a productive research phase. The Medical Department, the last unit to implement its research program, saw the completion of pathology, bacteriology, and biochemistry laboratories and of the research hospital within the structure of the former camp hospital. Thus, for the present time, each department has reasonably good, though limited, laboratory facilities. However, the Medical and Physics Departments are in temporary quarters, and Biology Department facilities need to be extended. Appropriations for the second phase of the Biology Department construction are available and plans are under way.

The over-all construction status of the Laboratory is shown in the accompanying chart (Figure 1). The total area in use is shown by quarters. New construction occupied during the past year includes the Cosmotron building (partial only), the hot laboratory, reactor laboratories, and the cyclotron - Van de Graaff building.



	1947				1948				1949				1950	
	1	2	3	4	1	2	3	4	1	2	3	4	1	2
NEW CONSTRUCTION	0	–	1	1	1	1	1	1	2	3	8	14	15	19
MODIFIED	–	8	22	27	28	29	31	33	34	36	33	33	34	33
NOT MODIFIED	14	19	29	29	29	31	32	32	31	30	28	25	27	26
TEMPORARY STORAGE	3	3	3	7	8	8	8	8	7	7	6	11	10	10
VACANT	83	70	39	27	25	20	17	15	16	14	17	13	12	10
NON-BNL	–	–	6	9	9	11	11	11	10	10	8	4	2	2

percent of total area

TOTAL AREA OF BUILDINGS by STATUS
(Quarterly Averages)

Figure 1.

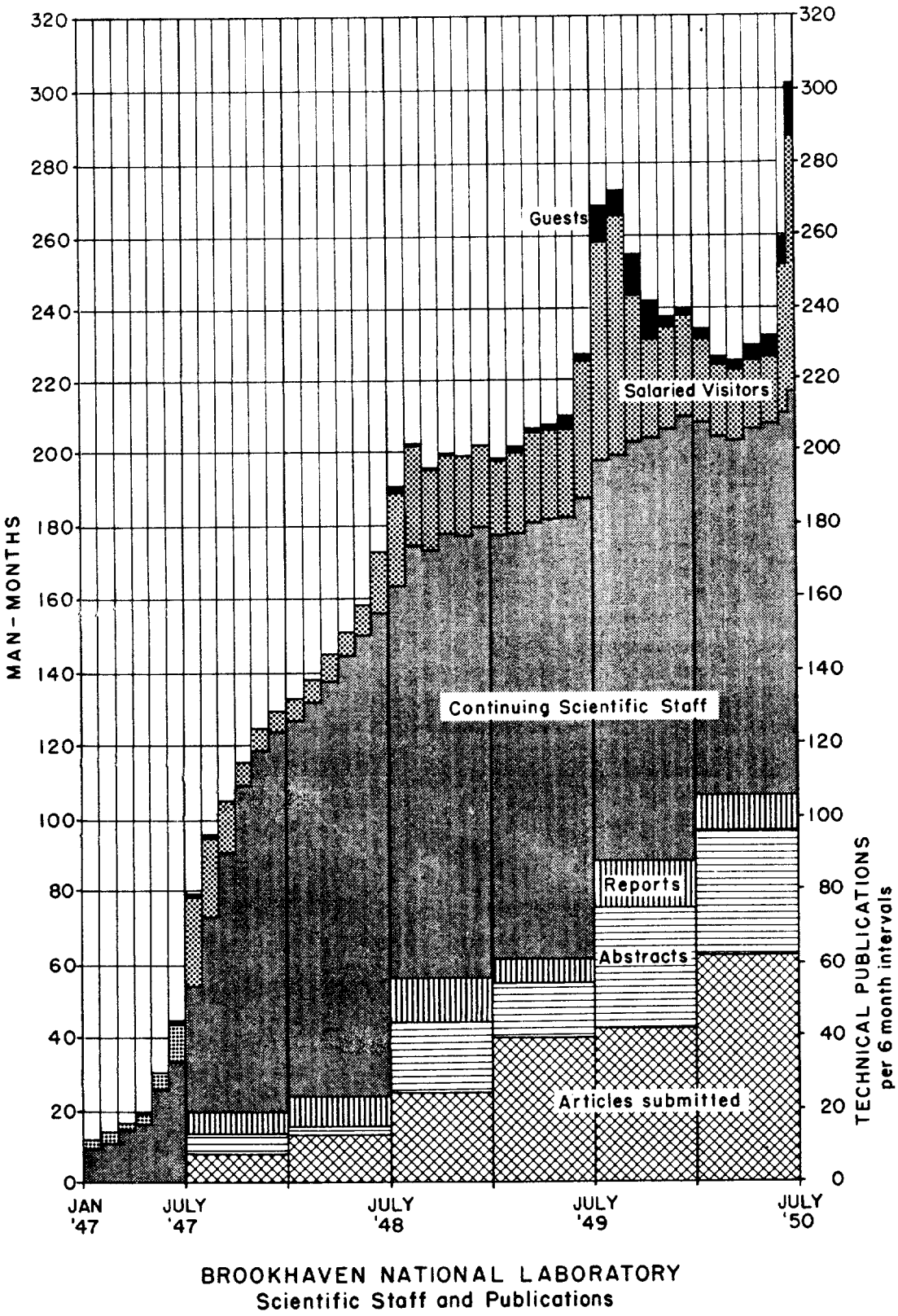


Figure 2.

The life sciences programs, biology and medicine, are progressing. The first phase of the Biology building program for permanent quarters was completed, and the building is occupied. The second phase of this building program for additional permanent facilities to accommodate the staff still housed in temporary structures, the additional continuing staff, and the on-leave staff will be started this year. The expanding research program now in progress emphasizes radiation biology and tracer studies.

The Medical Department contains the research divisions encompassing the fields of bacteriology, biochemistry, pathology, and physiology. This staff is the most recent addition to the Laboratory research staff, having been organized in 1949 and not yet up to full strength. In fact, the Physiology Division is to be activated in the fall of 1950. The medical research program overlaps the biology program in part, but is directed specifically toward man. In cooperation with New York hospitals, studies using selected research patients are in progress. Atomic techniques are applied in attempts to improve on diagnosis, to effect cures, and to determine an understanding of certain specific afflictions.

Individual research programs are rounded out by technical conferences on specific subjects. Experts in the fields are invited as speakers, and interested scientists from other institutions are welcomed as participants. Seminars in physical and life sciences are scheduled regularly during the summer months, when a large number number of the summer visitors are represented on the programs.

The operating expenditures for fiscal year 1950, totaling approximately $7,500,000 are shown in detail in Figure 3. The capital equipment expenditures of $477,664 are also shown. Figure 4 indicates the relative fractions of the operating expenses by programs in one case, and by major category in the second case. During the course of the year, stringent reductions in all Laboratory activities and curtailment of expansion resulted in a transfer of $1,269,112 from the Operating and Capital Equipment Budgets to the Facilities Budget for application to the reactor alteration program and to increased cyclotron costs. An operating budget of $7,863,700 for Laboratory operations and $132,000 for AUI administration and public education (total AUI-BNL, $7,995,700) has been approved for fiscal year 1951.

At the present time, the Laboratory has contractual arrangements with seven industrial companies for performance of work necessary to construction, operation, and maintenance. These contracts are usually let on a lump sum basis after competitive bidding. Where the work involved is research and development or where personal services are sought, other criteria of selection are naturally used. These arrangements are normally made on a cost plus fixed fee, or other cost reimbursement basis. Where the contract is with another nonprofit organization such as a university, the contract is designed simply to cover all direct and indirect costs of the work. Six such contracts have been negotiated with northeastern educational institutions.

A second category of contracts includes those designed to assist other institutions to solve specific scientific problems, in line with the Laboratory's research program. This type is still small numerically, but is hoped to increase as more and more major research facilities are completed. The arrangements for these contracts differ from case to case. In making these arrangements, especially where services of Laboratory personnel are involved, great care is exercised to avoid conflicts with work of the Laboratory staff or with the policies of the AEC.

with that of the yeasts on which they feed that it is proving necessary to examine the metabolism by yeast of our strain of both barium and lanthanum. At this preliminary stage it appears that the yeasts selectively reject barium, while accumulating lanthanum. This, should it be confirmed, will be quite surprising, and will also provide us with a new tool for ascertaining the quantitative relative importance, in Drosophila nutrition, of the yeast cells and of the medium on which both grow.

The extended examination of the iron metabolism of larvae of six different species of Drosophila has almost completed its experiment phase. Since this has produced a few thousand slides, both serial autoradiographs and stained preparations, the complete assembly of the data will require considerable additional time. Enough information is now at hand to satisfy the main purpose of the study, and to ascertain whether the histochemical iron stains which have been found by D.F. Poulson, indicating clear differences among the various species, can be used reliably as indicators of fundamental iron physiology. As expected, the staining reactions do not appear to yield reliable information of the metabolism of iron. This is a point of very real importance, since in insect physiology the classical method of finding regions of absorption in the intestine has been feeding iron and then staining. It is evident that most of the descriptions based on this must now be re-evaluated.

In the interstices of the work described above, a program of mineral analysis of marine sponges has been pursued. This study has real practical interest in connection with the cycles of the various trace elements in the sea, now being considered in connection with marine disposal of radioactive waste products. It is also of great fundamental importance in comparative biochemistry, since other workers are studying, on the same material, the various organic fractions so that one may hope to find correlations between organic and inorganic constituents. In the plant kingdom, many of the most bizarre and instructive phenomena of mineral nutrition have turned up in the lower forms, and it is hoped that this will prove equally true of the animals. As data accumulate, it is planned to supplement this program with tracer studies.

Tracer investigations have been made of the uptake and transfer of iodine, phosphorus, and iron by various typical fresh water organisms. The main purpose of this study, still being pursued, is to find short-lived radioisotopes whose movements in nature may be used as indicators of the movements of carbon, for which no suitable isotope is available. Although no success has yet been achieved in this direction, information of real biological value has been obtained. It is reasonable to mention, out of this body of data, that iodine metabolism by Cladocera, minute aquatic relatives of the lobster, appears to differ greatly from that known for insects and some aquatic worms and mollusks. Also, it appears that Cladocera and two species of aquatic insect larvae, contrary to expectation, have no mechanism for the conservation of iron, which has been described as a limiting nutrient for some other plankton species.

MEDICINE

Due to a redistribution of Laboratory operating funds, the Department's personnel expansion program was retarded during the past 6 months. However, plans are now under way to acquire the scheduled number of personnel.

As of June 30, 1950, personnel on full or part-time duty in the Medical Department numbered 73, as compared with 63 on December 31, 1949, and 44 on June 30, 1949. At present, the staff includes 9 full-time physicians, 5 of whom are senior members, 2 full-time medical scientists, 1 of whom is a senior staff member, and 3 part-time physicians, of whom 2 are medical examiners and 1 is a roentgenologist. In addition, 1 physician is on leave of absence because of illness. One year ago there were 5 full-time physicians, of whom 4 were in the Division of Industrial Medicine which at present has but 2. On June 30, 1949, of the total 44 employees on duty in the Department, 38 employees were in the Divisions of Industrial Medicine and the Hospital, 4 were in the Division of Pathology, and 2 were in the Division of Biochemistry.

The position of hospital administrator was abolished on March 1. The duties of the administrator were divided among the various supervisory personnel in the Department; thus far, operations have continued at a high level of efficiency. At the same time, many operations were decentralized. Each division maintained its own inventory instead of utilizing the pharmacy as a stock room. This resulted in a saving of 1 full-time person and a definite increase in efficiency, since the user always knows the status of the stock of materials he is using.

This report period has seen the attainment of the objectives of the Department's first stage of operations. These objectives were to complete organizational development, to train a nucleus of personnel in the methods and procedures to be followed, and to lay the groundwork for investigations of long-term character concerning the biological effects of radiation.

Division of the Hospital

On December 27, 1949, the hospital celebrated the first anniversary of operation, and on March 29, 1950, it celebrated the first anniversary of the admission of the first research patient. During the present fiscal year the hospital has shown a steady and gratifying growth. Patients have been admitted from New York, California, Georgia, Illinois, and Virginia, as well as the neighboring states of New Jersey, Pennsylvania, Maryland, and Connecticut. On January 9, 1950, the children's ward was opened, since all present bed space was occupied and sufficient personnel had been trained to permit us to open a ward for children. Within a month, all 8 children's beds were occupied and have remained so. At present, additional beds for children are on order to bring these up to a total of 14 so that the ward may be fully equipped.

During the last quarter of the year, operations were at near capacity and it was obvious that preparations must be made to obtain and train personnel for a third 14-bed ward. When this ward is opened, it will finally bring into use all the hospital facilities with which the Laboratory is presently provided. It remains the policy of

the hospital to reserve at all times a few beds for the use of employees, whether or not there are any actual patients. Our experience of the past 2 years suggests that 4 beds for adults will be sufficient for this purpose.

All activities relating to the patients' social welfare, recreation, and education have been centered under the occupational therapist. This section has had a very large growth in responsibilities during the review period. This can best be exemplified by citing the number of patient activities in the occupational therapy shop. From August 1, 1949, when the occupational therapist joined the staff, to December 31, 1949, there were a total of 239 shop activities in which 1 patient working in the shop for any period of time is taken as a unit. The total number of hours work in the shop was 108; the average per patient per day was one hour. From January 1, 1950 to June 30, 1950, there were 916 shop activities. A further increase in hours will be noted from a description of activities given below. In January 1950, an occupational therapy program was started on the children's ward (ages 2 - 5 years). A play therapy group was held every morning from 10:00 to 11:30 a.m. wherein the children carried on various activities such as drawing, modeling clay, cutting out figures and pasting, playing rhythm band instruments, and just playing. This has turned out to be a most successful activity. At the same time, a daily schedule was set up for adult female patients from 1:00 to 3:00 p.m., and for male patients from 3:00 to 5:00 p.m. These were well attended by the patients. Beginning in March, the Sayville Chapter of the American Red Cross completed arrangements for a group of Grey Ladies to come to the hospital two afternoons a week to assist in the patients' recreation and welfare. Games were conducted for adults and children and a weekly class in typing was begun for school-age patients. Recreation was provided by the Young Peoples Fellowship Group from Christ Church, Episcopal, at Bellport. This group came regularly one evening a week beginning December, 1949, to show movies to the patients. When the warm spring weather was expected, a flower and vegetable garden was started by the patients; equipment was obtained for shuffleboard, clock golf, and croquet. These could be played on the grounds adjacent to the hospital. A piano was obtained for a very nominal sum for those patients who can play and for patient entertainment. These ancillary services to patients are exceedingly important as a part of their total care and well-being. In this hospital, the patients remain completely removed from their families and their normal social and entertainment contacts for considerable periods of time. Visitors are few and relatively infrequent because of expense and distance. In order to maintain the psychological well-being of our patients and their ready psychological acceptance of the new treatments, it is absolutely necessary that some substitute be offered for those activities which are cut off. To date our program has been most successful, hampered only by limitations of space and accessibility. This small program, carried out at a very small cost, has added greatly to the patients' contentment and well-being, and has thereby enabled us to carry out numerous observations which otherwise would have been impossible.

Statistics for the patients in the hospital are shown in Table 1. It will be noted that the increase in research patient days for the last six months of this fiscal year is just over 100%, whereas the nonresearch patient days for this period show a decrease of 55%, due largely to the discharge of two chronically ill employee patients.

Research patients during this period comprised those with carcinoma of the thyroid, Graves' disease, leukemia, and the nephrotic syndrome in young children. During the interval, the patients have been increasingly utilized for investigational work bearing on problems associated with radioactive isotopes. In general, this had

developed after the organization of the laboratory to dilute and measure isotopes, as noted in the report for the Division of Biochemistry. Treatment of the thyroid patients has been with I^{131} throughout the period. All of the patients with carcinoma were thyroidectomized surgically before treatment with radioactive iodine was begun. In each of these patients, it is necessary to stimulate the tumor with thiouracil or thiouracil and thyrotropic hormone to cause it to take up the iodine satisfactorily. At the present time, in some patients therapeutic doses can be given at long intervals only, and a new approach to treatment in these patients is needed urgently. Work on this aspect is planned for the next interval. In the patients under observation for the past year, there is no evidence to suggest that a near cure has been effected. In some, there is a suggestion of control of the growth of the tumor following the repeated radiation, but this, as noted above, cannot now be given frequently enough to fully control the cancer. The easy optimism which has been broadcast in the popular press in regard to treatment of patients with thyroid carcinoma finds no support in the cold facts obtained by our observation. There can be no question of the value and worthwhileness of this therapy to these individuals, and for some surcease from the disease, radioiodine is irreplaceable. The goals reached by it are, however, limited and these limits must become generally known by the public as well as the profession if the best results are to be obtained.

Table 1

Hospital Statistics

Patient Days	Dec. 1948	Jan. 1-June 30, 1949	Fiscal 1949	July 1-Dec. 31, 1949	Jan. 1-June 30, 1950	Fiscal 1950
Research	0	423**	423	1208	2551	3759
Employees						
occupational	0	81	81	0	0	0
nonoccupational	6*	220	226	180	71	257
dependents	0	46	46	26	61	87
Total	6	770	776	1414	2689	4103

*First patient admitted December 27, 1948.
**First research patient admitted March 29, 1949.

In the patients with Graves' disease, the use of radioiodine has permitted us to achieve a reduction in gland function which could not be sought surgically for these individuals. In each instance the result has been gratifying. The experience in handling isotopes for use in this group of patients has greatly expedited training of the professional staff of the Hospital. While radioiodine is an effective thyroidectomizing agent, it is our belief that it should not be the method of choice in treatment of patients with Graves' disease because of the as yet not evaluated hazards of radioiodine over a long period.

Figure 1. Section of shell being removed from a chicken egg to provide a window for the injection of virus to the embryo.

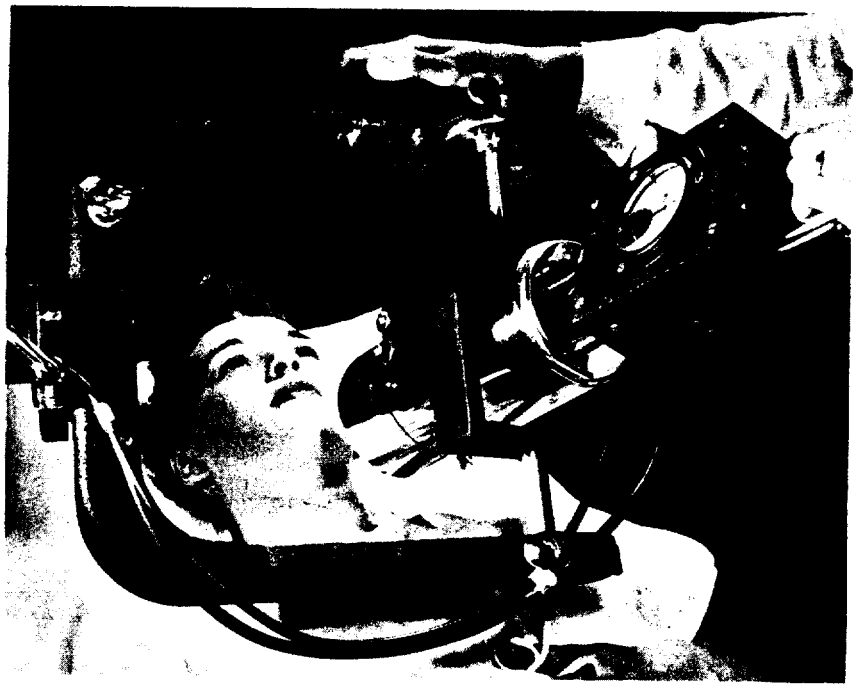


Figure 2. Radiation count being taken on a thyroid patient in the Laboratory Hospital counting room.

During the latter part of the review period, it was possible to begin studies in the distribution of body sodium and rates of equilibration of Na^{24} in young edematous children with the nephrotic syndrome. During this time, the studies made on these children were preliminary. However, they were extensive enough to yield information of some theoretical interest and to enable us to modify the procedures in such a manner that further studies can be done. In each instance, a very small dose of the 14.8-hour half-life isotope was given on the order of 5 μc per kg of body weight. Calculations indicate that the total radiation from such a dose, which is in fact evenly distributed in the body extracellular fluids, would radiate less than the tolerance dose during its period in the body. In dealing with the children, extraordinary precautions are taken to insure absolute safety at all times. The information to be obtained by this study is of very considerable importance and has an immediate application in the drug dosage and manner of administration to these children when they are stricken with bacteremia and peritonitis, all too often fatal. It will permit certain observations also to be made of the nature of the kidney lesion which so frequently progresses to complete loss of function and death.

A counting room has been set up to do in vivo counting in patients so that both the take-up of various lesions can be determined as well as scanning for new lesions carried out. Some improvements in the equipment and set-up are planned for the near future.

Additional nurses, orderlies, matrons, and kitchen assistants are needed greatly at this time to take care of the increased work load as represented by the increase in hospital days for this period.

Division of Industrial Medicine

As of June 30, 1950, personnel of the Division comprised 2 full-time physicians, 4 part-time physicians, of whom 3 are medical examiners and 1 is a roentgenologist, 9 technical staff members which includes 3 registered nurses, 3 clerical staff members, and 2 service staff members for a total of 20 as compared to 16 one year ago. After the start-up of the reactor, the routine examinations will increase and 2 additional full-time physicians will be required.

Personnel visits to the clinic have remained quite steady during the year and it is believed now that demands for this service can be predicted quite accurately. Special examinations will increase as the reactor becomes operative. These will be conducted as a precautionary measure. Statistics on clinic visits are shown in Table 2.

The clinic laboratory has carried out all the hematology for the hospital during this period. The number of technicians in the clinic laboratory dropped to 3 during one 6-week period due to the absence of one technician who has subsequently returned to her duties. Despite this reduction in personnel the work was satisfactorily performed.

The X-ray statistics are shown in Table 3. The load in this group is now approximately constant except for an increasing amount of work on research patients. It is believed that the present equipment is adequate for present employee health needs.

Table 2

Statistics on Clinic Visits

Visits	July 1-Dec. 31, 1948	Jan. 1-June 30, 1949	Fiscal 1949	July 1-Dec. 31, 1949	Jan. 1-June 30, 1950	Fiscal 1950
Employees						
occupational causes	840	490	1330	538	696	1234
nonoccupational causes	2905	2684	5589	2723	2037	4760
subcontractors	141	133	274	151	230	381
dependents	141	436	577	442	407	849
preemployment examinations	124	156	280	194	97	291
annual examinations	676	622	1298	491	804	1295
Total	4827	4521	9348	4539	4271	8810

Table 3

X-ray Examinations

Examinations	July 1-Dec. 31, 1948*	Jan. 1-June 30, 1949	Fiscal 1949	July 1-Dec. 31, 1949	Jan. 1-June 30, 1950	Fiscal 1950
Employees, nonoccupational	69	116	185	93	100	193
Employees, occupational	0	69	69	52	83	135
Employees, dependents	6	32	38	43	36	79
Annual and Preemployment Examinations						
14 x 17 films	159	265	424	344	454	798
P F X films	178	524	702	294	463	757
Hospital Patients, nonresearch	0	12	12	9	14	23
Hospital Patients, research	0	19	19	78	125	203
Total	412	1037	1449	893	1275	2168

*The X-ray group began operations on October 11, 1948.

During the review period, one employee became contaminated with Sr^{90} and Y^{90}. This person has been repeatedly examined physically and with laboratory aids. Urine analyses have been carried out through the generosity of the Oak Ridge National Laboratory. Most of the contaminating chemical was removed immediately, but a small amount was either inhaled or ingested and became fixed in the body. The latest analyses indicate the patient is now cleared of radioactive contamination. Examinations

of additional employees for radiation cataracts were all negative. Those employees who might in the future be exposed to radiation which would cause cataracts have also been examined to be certain of the absence of any defects prior to radiation exposure if it occurs. Examination with a slit lamp is planned for this group as soon as the equipment is received.

Physicians in this Division continued their inspections of the cafeteria and were aware of all health developments effected by changes in sanitary conditions, garbage disposal, and similar public health problems. Members of the Division consulted with other members of the Laboratory staff on these problems as the needs arose.

During the year the general health of Laboratory employees was excellent. Very few employees developed medical illnesses and injuries were few and relatively minor as a whole. Definite plans have been laid for protection of employees' health when the reactor begins operation; it is to be hoped that accident and injury rates can be maintained at their present low levels.

Division of Biochemistry

As noted in BNL 39 (AS-3), this Division took over part of a building which has been improvised into a biochemistry laboratory and is now functioning. During the last six months of the review period, plans were completed for the remodeling of another building in order to provide more suitable quarters for the Division. It is believed that the contract will be let shortly after the beginning of the new fiscal year and that the remodeled laboratory will be ready for occupancy about January 1, 1951.

One year ago personnel in the Division numbered only 2, of whom 1 was a junior scientist and 1 was an administrative assistant. At this date, there are 2 senior scientists, 3 junior scientists, 4 technical assistants, and 1 clerical assistant, for a total of 10 people working in the Division, although technically, at the present time, 1 senior scientist is carried on the administrative officer roster. Further expansion of the Division will take place during the coming year in both personnel and work. Although there has been some research accomplished during the past year, the major effort was the organization and setting up of necessary methods in the laboratory.

On February 2, 1950, Dr. J.S. Robertson joined the Division to head the Department's Biophysics Section. At that time, the counting facilities consisted of an in vivo counting arrangement in the hospital, with the counter as yet unstandardized. This made it necessary to send patients to Memorial Hospital in New York City for any in vivo counts desired. Several patients were so transported to enable us to make estimations of uptake of radioactive iodine by the thyroid gland and tumor metastases. In the laboratory, a Marinelli cup counter was available for counting liquid samples. At this time all iodine doses were obtained from Memorial Hospital through our consulting staff.

Beginning in February, existing facilities were expanded as follows. There was obtained equipment necessary for remote handling and pipetting of radioactive sources, i.e., a remote-controlled bottle clamp and opener, and a motor-driven pipette manipulator. Lead bricks were obtained for necessary shielding of sources. An electrometer was placed in service. This equipment enabled us to receive the

Figure 3. Three-year old child upon admission to the Brookhaven National Laboratory Hospital, showing typical swelling of the nephrotic syndrome.

Figure 4. Same child after 9 months in the hospital.

1 clerical assistant comprise the staff. Further personnel plans for the Division call for but 1 additional junior scientist and 1 more technical assistant to come to full strength.

As noted in the last progress report (BNL 39(AS-3)), the Division began work in improvised quarters. In September it moved to better improvised quarters before the present building became available on December 15, 1949. Since that time, it has been possible to extinguish the infected mouse colony and to develop clean "infection free" breeding stock to a point where all present needs for experimental mice can be met from the Division's own stock.

The 2-curie Co^{60} source was soon found to be too small for adequate experimentation, although experiments done with this source were suitable to show the need for a better source for study of the various infectious processes of bacteria and viruses in mice. When the needs were made known, the Reactor Science and Engineering Department designed a 72-curie source which, it is believed, will meet the Division's immediate needs for a radiation source. This is now in the process of construction and the cobalt has been ordered. It is planned to locate the new source in the hot laboratory, since no facilities for a source of that intensity are now available in the Division's laboratories.

Considerable preliminary work has been done on tumor immunity using transplantable and spontaneous tumors in mice. At the present moment attention is being directed primarily toward the relation of homologous tissue immunity to the development of tumor immunity. Preliminary experiments which have been completed have served as pilots for development of procedure and techniques.

Irradiation of chick embryos in the present 2-curie source has indicated that for such experiments the larger source designed for the mice will be desirable. With the present source it is impossible to give the required amount of radiation to significant numbers of chick embryos within the time at one's disposal. This work will be enlarged in scope and intensity when the new source becomes available.

Preliminary data on effects of irradiation on "infection free" mice were given in the quarterly progress report (BNL 51 (S-5)). Further significant data along this line have also awaited completion of the 72-curie Co^{60} source.

Some preliminary work has been done on bacterial nutrition involving, in part, the type transformation of the pneumococcus. This work is being continued at present.

During the year, the Division has made 556 determinations on 155 specimens obtained from patients in the out-patient clinic and the hospital.

Division of Pathology

One year ago, this Division had a total of 4 employees, whereas 6 months ago there were 7. On June 30, 1950, there were a total of 8 employees, 2 of whom are scientists. In addition, 1 senior scientist remains on a leave of absence because of illness. As noted in the last semiannual progress report (BNL 39 (AS-3)), the

isotopes directly from our source custodian, and to perform the necessary standardizations and dilutions, together with the required preparation for administration. Therefore, it was no longer necessary for us to depend upon an outside institution for assistance.

A second in vivo counting arrangement was installed in the hospital counting room. This consisted of a second shielded gamma-sensitive G-M tube, together with a scaler. This makes it possible to count over a given region and over a control area simultaneously. The scalers for both tubes are mounted in a single rack with a master control panel.

In the laboratory, a shelf counter using an end window G-M tube in a lead housing with a scaler was obtained and put into use for counting solid samples.

All of the counting circuits in use have now been calibrated for absolute counting. Determinations of the corrections for geometry and for coincidence losses have been made for the in vivo and the shelf counters.

Procedures for many of the biochemical analyses to be done on patients are now in operation. Further methods particularly useful for renal function studies will be instituted during the next month.

Using Na^{24}, studies have been started on the rate of turnover of Na^{24} in tissue edema fluid and in ascitic fluid of nephrotic children. The first experiments provided information regarding the most suitable procedures to plan. It was found that the extracellular water compartment of the body, as measured by Na^{24}, comprised a larger percentage of body weight than was anticipated. In five nephrotic children this has ranged from 35 to 47% of observed body weight, as contrasted with a normal figure of about 20%. It has become apparent that the time required for equilibrium to occur is greater than was expected and is a very considerably larger period than is observed in normal adult individuals. A complete study of the children presently in the ward will be done during the next two months for total Na^{24} space and changes in that space as associated disease manifestations become altered.

In collaboration with the Biology Department, the manometric wet carbon combination method of Van Slyke and Folch has been modified so that the total carbon of the sample is first measured as CO_2 and the gas is then quantitatively transferred for measurement of radioactivity. The radioactivity may be measured by quantitatively precipitating the CO_2 as barium carbonate and counting from a disk applied to a methane flow counter, or by transferring the CO_2 to an evacuated gas counter of the type designed by Ballantine and Bernstein. This latter method is particularly advantageous for small amounts of C^{14}. This method enables studies to be done on smaller amounts of biological material than was heretofore possible and with no loss of accuracy.

Division of Bacteriology

This Division has been entirely staffed and organized within the past year. On June 30, 1950, Dr. Horace T. Gardner reported for duty as a senior scientist. At the present time, 2 senior scientists and 2 junior scientists together with 5 technical and

Division moved to its present quarters about November 1, 1949. Final work on the facility was completed in December. Since then the laboratory has been available for research. In addition, a histological technician on the Hospital staff has been trained for tissue work. At the present time, the Division is offering pathological laboratory service for other divisions of the Department.

Research work is continuing on the influence of injuries and disease states upon the formation and fate of tissue and blood proteins. It is known that previously normal persons suffering from any one of a variety of acute conditions, such as physical injury with shock, bone fractures, radiation injury, certain inflammatory processes, and similar states will show an increased breakdown of general body protein. These patients will often show clinical evidence of delay in or even resistance to its regeneration during recovery. In most, if not all such conditions, the minimization of these protein losses and the facilitation of their restitution may be regarded as important medical goals.

With the aid of amino acids labeled with the isotopes N^{15} and S^{35}, we are studying the formation, the breakdown, and the reformation of certain of the body proteins of animals in which controlled abnormal states are induced. The influences of certain hormones, antibiotics and metabolites, upon the responses of these animals are an added part of the investigations. We are also interested in further discoveries of the functions of the many specific particles of which cells, as seen under the microscope, are composed. We are at present investigating the origin and fate of certain particles which can be seen in and separated from essential kidney cells after the animal has been injected with blood plasma, amino acids, or foreign proteins. This latter investigation is being conducted in collaboration with the Department of Pathology, Long Island College of Medicine of the State University of New York.

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Lee E. Farr, Chairman, Medical Department
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*Incumbent as of July 1, 1950.
**As of October 1, Dr. Howard J. Curtis will join the staff as Chairman of the Biology Department.
†Terminated before June 30, 1950.

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