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FOR JUNE 1949

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A Report Submitted

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W. E. Kelley, Manager

DEPARTMENT OF ENERGY DECLASSIFICATION REVIEW	
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## V. BROOKHAVEN NATIONAL LABORATORY

One important research project underway at Brookhaven National Laboratory is the genetical studies of Indian corn in determining biological effects of radiations. This work is described below.

Several technical publications and pile design and construction reports which were presented during June are summarized following the biological studies report. The current status of the cosmotron, the 3.5 Mev Van de Graaff and the 60-inch cyclotron is also discussed.

### Genetical Studies of Indian Corn

Genetical Monitoring of Biological Effect of Stack Gases. Sweet corn, since it is more sensitive to environmental conditions than field corn, is being grown by the Brookhaven Biology Department at 16 genetic monitoring stations surrounding the site. In addition to these 16 plots of about 1/3 acre each, two larger plots of two acres each, one southwest and the other southeast of the reactor, have been planted.

To obtain a comparison of mutation rates between Brookhaven and some other site located at a considerable distance from a reactor, it is planned to cooperate each year in duplicating here an experiment being conducted in another part of the country. A multiple tester stock developed at Harvard is being used as one plot, with a plan to study the mutation rate of at least one gene on every one of the ten chromosomes of maize. Study is also being made of the possibilities of differences between the mutation rates of the conventional tall type corn and the short type developed last year. This short corn, on account of the relative ease with which it can be detasselled, will be grown rather extensively in the crossing plots where mutation rates are being determined.

Effect of Constant Gamma Irradiation on Growing Plants. A 20 curie source of radioactive cobalt has been installed in one of the fields, which has been planted with various maize stocks, millet, sunflower, potatoes, tradescantia, snapdragons, marigolds, phlox, tomatoes, and fusarium cultures. The plantings are in the form of concentric circles around the source, in such a way that the radiation intensities will vary from 26 r/hr at 1 meter to tolerance levels of 50 mr/day in the out circles. Genetic changes are expected at the higher dosages but not in the outmost circles 38 meters from the source. A careful study of the plants growing in the different circles should reveal the amount of constant gamma irradiation necessary to produce a genetic change, and also the possibilities of adverse or beneficial effects of radiation. It is also hoped to determine the lethal dose for germinating seeds (also dry seeds) by placing them in trays constructed around the upright pipe containing the source. Seeds and seedlings will thus be located 1/2 meter from the source, and will receive 104 r/hr. In addition to corn, young tomato plants will also be subject to this high level of radiation, the latter being part of a cooperative experiment conducted with the Connecticut Experiment Station.

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Study of Genetics and Physiology of Sucrose Production in Corn Stalks.

In 1947, it was found that inbred field corn contained almost as much sucrose in the stalk juice as sugar cane. Although this sucrose content varies greatly with individual plants, as indicated by hand refractometer readings, it appears possible to select progenies of a higher reading than any available at present, by the hand polination process. There is a possibility that these sweet stalk inbreds may be used to produce sugar from corn stalks, or to produce a silage for higher feeding value for cattle. In conjunction with this investigation further research will be made on physiology of sugar production in corn stalks.

Publications and File Reports

During June the Laboratory published two additional issues Number 2, Vol. 2 of the "Guide to Russian Scientific Periodical Literature". A technical report on "Properties of Atomic Nuclei II Range - Energy Curves", by Hans A. Bethe, was also presented. A considerable amount of material compiled during the month concerned the design and construction of the Nuclear Reactor. The following is a listing of the pile manuals, all of which has been written by the H. K. Ferguson Company with the exception of Book Nr. 3 which was prepared by M.I.T. —

- Book Nr. 1 -- Design Manual
  - Volume 1 -- General Codes and Data
  - Volume 2 -- Utilities & General Site Service (not completed)
  - Volume 3 -- Pile
  - Volume 4 -- Pile Auxiliaries
- Book Nr. 2 -- Pile Operating Manual
- Book Nr. 3 -- Manual of Instruments and Controls
- Book Nr. 4 -- Process Instrument Manual
- Book Nr. 5 -- Pile Maintenance Manual
- Book Nr. 6 -- Laboratories Manual (not completed)
- Book Nr. 7 -- Boiler House

Cosmotron

The Cosmotron Project was reported in detail in the February report. The following will bring this report to date --

The first of the 288 six-ton blocks for the magnet of the Brookhaven cosmotron arrive on July 1 with other pilot blocks scheduled to follow next week. Production deliveries will start soon after. A building has been completed for the magnet block test; the M-G set for magnet testing has been received and its foundation and housing is presently under construction. A contract has been awarded to the Hyre Electric Company of Chicago to wind the 70 tons of copper coil material around the magnet quadrants. The Hyre Company will arrive on the site to begin preliminary work July 5. First shipment of coil material has been received. Extensive tests have revealed that the desired ceramic vacuum chamber cannot be constructed strong enough to withstand the required vacuum and it has been of inconel. Development work is proceeding on cross-section and sealing details.

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Design of all radio frequency accelerating components is practically complete. An oscillator has been designed meeting design requirements and an experimental unit is being constructed. Preliminary experiments indicate that this design will be satisfactory. Design for the necessary power amplifier has been completed and a model constructed; preliminary tests indicate a successful design. Considerable progress has been made in solving the problems of coupling the RF power to the protons by means of an RF transformer. A RF transformer has been designed around a special ferro-magnetic material known as ferrite, but extensive testing will be required before a final design is determined. Models based on this material have been constructed and will be tested shortly. The DC rectifier to power the RF amplifier driving this transformer is on order. The fourth RF problem involving the control of frequency track with magnetic field has been solved on paper and components are being manufactured for testing.

Reports from the Westinghouse Electric Corporation and High Voltage Engineering Corporation reveal that the manufacture of both the main MG power supply unit and the Van de Graaff injection generator are proceeding on schedule.

Formal invitations to bid on the cosmotron building were issued June 10 and bids are due July 1. Many long term delivery items for this building have been ordered and are scheduled for early delivery.

#### 3.5 Mev Van de Graaff Accelerator

The 3.5 Mev Van de Graaff machine has been shipped from General Electric and the first portion was received July 1. A contract for erection and installation has been granted and it's expected that by July 30, the machine will be operating. Preliminary tests at GE reached a voltage level of 2.5 Mev with a beam of from 1/2 to 2 microamperes before excessive spark-over resulted. This was believed to be caused by corona points being set too close, or the pressure being too low. The General Electric Company expects to reach 3.5 Mev after they have set up the machine this summer at the Brookhaven Laboratory.

#### 60-Inch Cyclotron

The 60-inch cyclotron magnet and power supply units have been installed and tests have shown the homogeneity of the magnet field to be excellent and the power supply units and cooling apparatus to be completely satisfactory. Shipment of the balance of the cyclotron components is expected during the summer months. The building which will house the cyclotron and Van de Graaff machines and their allied laboratories has been completed and will be accepted from the construction contractor on July 1, 1949.

## VI. MEDICAL

Twenty-four field trips to nineteen contractors were made by NYOO Health and Safety personnel during June. An extensive survey of the uranium and fluoride content of effluent from the Harshaw Chemical Company plant in Cleveland, Ohio, was made. Arrangements were made to finish development of the Cascade Impactor by the University of Rochester.

Sixteen medical or biological research contracts were negotiated during fiscal year 1949 at the request of the Division of Biology and Medicine. These are listed below.

### Health and Safety

The NYOO Health and Safety Branch made 24 field trips of one or more staff members to 19 contractors. These visits included safety and fire protection inspections, ventilation studies, radiation surveys and special measurements, waste disposal investigations and advice to contractors on shipment of radioactive materials.

One of these trips was an extensive investigation into the nature and distribution of the uranium and fluoride content in the effluent of the Harshaw plant in Cleveland. A summary of the results will be included in the July monthly report.

Arrangements have been made to complete development of the Cascade Impactor air sampling device and arrange a production run to fill the Commission needs as well as those of the Armed Forces. Development will be completed by the University of Rochester under its present contract and production will be undertaken by a direct Government contract. This work has been requested by the Radiation Instruments Branch, Oak Ridge.

### Medical and Biological Research

During fiscal year 1949, NYOO negotiated contractual arrangements for sixteen medical or biological research projects at the request of the Division of Biology and Medicine which furnished NYOO with an approved proposal and budget for each project. It is expected that most of these contracts will be renewed since the work is of continuing interest. Arrangements have been made for adequate security monitoring of all contracts.

The sixteen medical or biological research contracts are:

Johns Hopkins University (AT-(30-1)-498) - sanitary engineering aspects of radioactive waste problems including the investigation of actual sewer systems. Responsible Investigators: Drs. A. Wolman and C. Renn. The contract covers the period November 15, 1948 to November 14, 1950 with funds specified for the first year in the amount of \$16,336.44 including a supplement to the original program. The contractor's contributions were in acceptance of an overhead of 8% of the total, and in furnishing supervision of the project at no cost to the Government.

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Columbia University (AT-(30-1)-505) - use of radioisotopes in the investigation of thyroid physiology. Responsible Investigator: Dr. S. C. Werner. The contract runs from February 1, 1949 to January 31, 1950 with funds of \$5,200 allocated for the year. The contractor's contribution is in acceptance of an overhead of 25% of salaries and in furnishing supervision of the project at no cost to the Government.

Mt. Sinai Hospital (AT-(30-1)-529) - basic physical measurements for tissue dose delivered by beta and gamma radioisotopes. Responsible Investigator: Dr. S. Feitelberg. This contract covers the period February 15, 1949 to February 15, 1951 with funds of \$5,500 allocated for the first year. The contractor's contribution is in acceptance of an overhead of 10% of the total cost and in furnishing supervision of the program.

Long Island Biological Association (AT-(30-1)-557) - the dynamics of laboratory populations under the effects of irradiation. Responsible Investigator - Dr. M. Demerec. The contract runs from March 1, 1949 to February 28, 1951. Funds of \$43,000 have been allocated for the first year. Contractor's contribution is in acceptance of an overhead of 10% of salaries and in furnishing supervision of the project.

Yale University (AT-(30-1)-568) - effect of radiation on monomolecular layers of serologically active substances and on self duplicating systems. Responsible Investigator: Dr. E. C. Pollard. The contract runs from June 1, 1949 to May 31, 1951. Funds have been allocated in amount of \$12,400. Contractor's contribution is \$14,500.

Connecticut Agricultural Experiment Station (AT-(30-1)-508) - therapy of plant disease using nuclear radiations. Responsible Investigators. Drs. J. G. Horsfall and A. E. Dimond. July 1, 1949 to June 30, 1951 with \$8,000 allocated for the first year. The contractor's contribution is \$8,000.

Marine Biological Laboratory (AT-(30-1)-591) - training of Fellows in biological research using radioisotopes. This work will be carried on under the general supervision of Dr. G. Failla who will be spending the summer at the Contractor's laboratory in Woods Hole, Mass. The estimated cost of this contract is \$8,300 including \$3,000 for special equipment.

Harvard University (AT-(30-1)-609) - basic medical and biological research. Responsible Investigators: Drs. A. B. Hastings, S. Warren, J. Aub and A. K. Solomon. The contract covers the period June 1, 1949 to May 31, 1951. This is a two-year cost contract in the amount of \$271,124 and is a continuation of work carried on with AEC funds by the Office of Naval Research up to May 31, 1949.

Massachusetts Institute of Technology (AT-(30-1)-621) - investigation of present water treatment processes for removal of radioactive contamination. Responsible Investigator: Dr. A. Thomas. The contract covers the period May 15, 1949 to May 14, 1950. This is a programmatic contract and the budget for the year is \$50,000.

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University of Pennsylvania (AT-(30-1)-663)- synthesis and study of isotopic carbon compound used in biochemistry. Responsible Investigator: Dr. D. W. Wilson. The contract covers the period July 1, 1949 to June 30, 1952 with \$10,700 assigned for the first year. The contractor's contribution is \$4,480.

Massachusetts General Hospital(AT-(30-1)-667) - effects of radioactive iodine on biology of the thyroid. Responsible Investigator: Dr. J. H. Means. The contract covers the period July 1, 1949 to June 30, 1951 with \$22,680 assigned for the first year. The contractor's contribution is \$8,620, acceptance of an overhead of 8% of the total, and supervision of the project. In addition, professional services in the amount of \$22,725 are being made available through the Hospital at no cost to the Government.

Harvard University (AT-(30-1)-675) - mechanism of destruction of red blood cells. Responsible Investigators: Drs. T. H. Ham and W. B. Castle. The contract covers the period July 1, 1949 to June 30, 1951 with \$10,838 assigned for the first year. The contractor's contribution is \$5,122.

Harvard University (AT-(30-1)-698) - metabolism of teeth. Responsible Investigators: Drs. R. F. Sognaes and J. H. Shaw. The contract covers the period July 1, 1949 to June 30, 1951 with \$11,708 assigned for the first year. The contractor's contribution is \$532.

Harvard University (AT-(30-1)-699)- radiation effects on rat embryos. Responsible Investigators: Drs. Olive Gates and S. P. Hicks. The contract covers the period July 1, 1949 to June 30, 1951 with \$10,363 assigned for the first year. The contractor's contribution is \$1,719.

University of Rochester (W-7401-eng-49)- a project to investigate the thermal effects of flash burns has been added to this contract. Responsible Investigator: Dr. H. Pearse. It is anticipated that this work will continue for 3 years although present contractual arrangements exist only for the first year. Although this work is programmatic, with the budget for the year at \$87,250, contributions were arranged from the University of Rochester in the amount of \$2,500 and from the Atomic Energy Project at Rochester in the amount of \$4,100.

University of Rochester (W-7401-eng-49) - a project to produce radiation illness in rats and dogs and the dependency of radiation illness on dose rate has been added to this contract on request of the RW Project at the University of Chicago. Responsible Investigator: Dr. W. F. Bale. The work was begun in February 1949 and will be completed before the end of this year. This work is programmatic and the budget is \$17,600.