PRNC 56

PUERTO RICO NUCLEAR CENTER

PROGRAM AND ABSTRACTS

FOR THE

U. S. ATOMIC ENERGY COMMISSION – DIVISION OF BIOLOGY AND MEDICINE

BIO-MEDICAL PROGRAM DIRECTORS MEETING

SAN JUAN, PUERTO RICO

FEBRUARY 8-9, 1965

OPERATED BY UNIVERSITY OF PUERTO RICO UNDER CONTRACT
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U.S. ATOMIC ENERGY COMMISSION - DIVISION OF BIOLOGY AND MEDICINE

BIO-MEDICAL PROGRAM DIRECTORS MEETING

San Juan, Puerto Rico

February 8-9, 1965

MONDAY, February 8

Puerto Rico Nuclear Center - Río Piedras

8:30- 9:00 A.M.	Program of the P. R. Nuclear Center	John C. Bugher, M.D.
9:00-10:00 A.M.	Terrestrial Ecology Program, Part I	Howard T. Odum, Ph.D.
10:00-10:15 A.M.	Coffee Break	
10:15-11:30 A.M.	Terrestrial Ecology Program, Part II Schistosomiasis Program Medical Science & Radiobiology Division	Paul Weinbren, M.D.
11:30-12:00 N.	Resonance in Radiation Effects Program	Henry J. Gomberg, Ph.D.
12:00- 2:00 P.M.	Lunch	
2:00- 2:45 P.M.	Radiotherapy and Cancer Division	Víctor A. Marcial, M.D.
2:45- 3:15 P.M.	Nuclear Power Program of Puerto Rico	Modesto Iriarte, Ph.D. Puerto Rico Water Resources Authority
3:15- 3:45 P.M.	Civil Defense in Puerto Rico	Juan César Cordero Major General U. S. Army
3:45- 4:00 P.M.	Coffee Break	
4:00- 4:45 P.M.	Tour of Bio-Medical Building	Amador Cobas, Ph.D.

TUESDAY, February 9

Puerto Rico Nuclear Center - Río Piedras

8:30- 9:00 A.M.	Clinical Applications Division	Sergio Irizarry, M.D.
9:00- 9:30 A.M.	Agricultural Bio-Sciences Division	Robert A. Luse, Ph.D.
9:30-10:15 A.M.	Radioisotopes Division	Edwin Roig, Ph.D.
	Organic Chemistry	H. Harry Szmant, Ph.D.
	Radiation Chemistry & Photochemistry	Malcolm Daniels, Ph.D.
10:15-10:30 A.M.	Coffee Break	
10:30-11:30 A.M.	Marine Biology Program	Frank Lowman, Ph.D.
11:30-11:50 A.M.	Sugar Cane Borer Project	David Walker, Ph.D.
11:50- 1:00 P.M.	Sandwiches & coffee to be served	
1:00- 3:00 P.M.	Executive Session	Division of Biology and Medicine

TERRESTRIAL ECOLOGY PROGRAM, PART I

TITLE: The Rain Forest Project

INVESTIGATORS: Howard T. Odum, Ph.D., Chief Scientist I, Principal Investigator; Francis K. S. Koo, Ph.D., Associate Scientist II; George Drewry, Associate Scientist I; Robert Smith, Oak Ridge Graduate Fellow; and Visiting Scientists.

DATE INITIATED: May, 1963

PURPOSE AND SCOPE:

(A) To study effects of gamma irradiation from 10,000 Curies Cesium on the Rain Forest system at El Verde.

(B) To study some mineral cycles of the rain-forest in relation to fall-out and atomic excavation.

(C) To characterize the circuits and metabolic energy pulses of a complex terrestrial ecological system so as to understand the consequences of irradiation and fall out storage.

CURRENT STATUS:

The Rain Forest Project at El Verde involves irradiation of a plot of lower montane forest with gamma radiation from a 10,000 Curies Cesium source. After 15 months of pre-irradiation studies and preparations at the radiation and control areas, irradiation began January 19, 1965. The source will be lowered for checks on Sunday, February 7, 1965, and a field trip for the visitors is to be arranged then. Part of the data from the pre-irradiation year, which is incorporated in the annual progress report, will be presented at the meeting.

TERRESTRIAL ECOLOGY PROGRAM, PART II

TITLE: Radiation Induced Variability in Indigenous Arthropod-Borne Viruses of Puerto Rico

INVESTIGATORS: M. Paul Weinbren, M.D., Chief Scientist II, Principal Investigator; Agustin Cajigas, M.D., Associate Scientist, Ad Honorem

DATE INITIATED: April, 1963

PURPOSE AND SCOPE:

The Puerto Rico Nuclear Center is to study the effects on tropical rain forest of exposure to a 10 Kilocurie Cesium^{137} gamma radiation source. The object of the portion of the investigation under discussion here is to seek evidence of change in the natural arthropod borne virus cycles occurring in the environs of the radiation site, whether resulting from change in the virus itself or in the vertebrate host or arthropod vector. Evidence of Arbovirus activity is being sought by attempting direct virus isolation (in infant white mice and tissue cultures) from trapped arthropods and blood samples collected from vertebrates in the area. The blood samples will also be used to obtain indirect evidence of virus activity by the results of various serological tests. Although some aspects of this study might be covered by laboratory experiments, the program as designed takes advantage of a unique opportunity for study in nature. One hypothesis that we are particularly interested in testing is that of reactivation of latent virus, which has become latent through identification of its nucleic acid with that of the arthropod host.

CURRENT STATUS:

The preliminary investigations are now necessarily completed because exposure has started. To date, 329 rats have been trapped a total of 1,024 times and over 300 blood specimens had been collected from them for virus isolation attempts and serology. 7,105 mosquitoes have been caught and processed for virus isolations. During the dengue epidemic this laboratory assisted in the investigations during which 28 isolations were made from serum and 30 from mosquitoes.

PUBLICATIONS:

"The Clinical Forms in Rift Valley Fever and Nairobi Sheep Disease," M.P. Weinbren, M.D., paper presented at the Seventh International Congresses of Tropical Medicine and Malaria, Rio de Janeiro, Brazil, September, 1963.

"Virus Studies conducted in the laboratories of the Puerto Rico Nuclear Center by the combined team (Puerto Rico Nuclear Center, Puerto Rico Department of Health, Communicable Disease Center)", Agustin Cajigas, M.D., M. P. Weinbren, M.D., paper read at the Symposium on Dengue in the Caribbean held conjointly with the 9th Annual Meeting of the Standing Advisory Committee for Medical Research in the British Caribbean, Kingston, Jamaica, April 13, 1964.

SCHISTOSOMIASIS PROGRAM

TITLE: The Mechanisms of Antigen-Antibody Reactions Following the Inoculation of Mice with Irradiated and Normal Schistosoma mansoni cercariae

INVESTIGATORS: M. Paul Weinbren, M.D., Chief Scientist II, Principal Investigator; John B. Villella, Ph.D., Associate Scientist II

DATE INITIATED: December 3, 1963

PURPOSE AND SCOPE:

The program is based upon work by Drs. Villella, Gomberg and Gould, and on basically similar information published by Sadun et al. The different groups have produced encouraging results, but to date no finite assessments of the degree of protection have been made, and the methods used have varied widely. The Michigan and Walter Reed groups have reported an acquired resistance to challenge with virulent S. mansoni cercariae after infection by cercariae which have been damaged by exposure to gamma irradiation. The differences in the work of the two groups seem to depend on the route of exposure to the cercariae; while Dr. Villella et al employs intraperitoneal infection, Sadun and his group prefer the percutaneous route.

The procedures we intend to use are, at this stage, directed towards: (1) defining useful parameters for assessing the effects produced and (2) comparing the effectiveness of different approaches to the problem. This program is scheduled over a two year period, by which time it will be possible to decide along what lines any further research might be pursued.

CURRENT STATUS:

Staff have been recruited and trained and experiments have been carried out to determine the number of paired cercariae necessary to produce a standard infection in mice.

MEDICAL SCIENCES & RADIOBIOLOGY DIVISION

TITLE: Medical Sciences & Radiobiology Division

STAFF: M. Paul Weinbren, M.D., Chief Scientist II, Head; John B. Villella, Ph.D., Associate Scientist II, Barbara Weinbren, B.M.B.Ch., Associate Scientist I.

DATE INITIATED: Division of Medical Sciences activated February 7, 1962, combined with Division of Radiobiology July 1, 1962 being the commencement of FY-1963.

PURPOSE AND SCOPE:

This Division was established:

(A) To conduct training and research in radiobiology at the cellular level with emphasis on medical applications.

(B) To establish and operate tissue culture facilities for its own program and also to serve others.

(C) To explore the utilization of nuclear energy in developing new knowledge of tropical diseases of man.

(D) To organize and operate a small animal laboratory needed for its own program and those of others.

CURRENT STATUS:

A tissue culture facility has been established. This is staffed in the main by individuals trained here and they are now in a position to carry out virtually all the procedures required for the application of tissue culture to radiobiological problems. We are now able to receive individuals for training in tissue culture for radiobiological purposes. The tissue culture facility is being used for a number of projects among which are: (1) The investigation at the cellular level of the biological effects of neutron capture by $Boron^{10}$; (2) A number of studies on the chromosomes in cultured human leucocytes; (3) An annual program in which, using materials provided on an NIH grant, we screen specimens for virus content. These specimens are obtained from children sent into hospital with acute neurological syndromes.

RESONANCE IN RADIATION EFFECTS PROGRAM

TITLE: Resonance in Radiation Effects Program

INVESTIGATORS: Henry J. Gomberg, Ph. D., Deputy Director, PRNC; and Robert A. Luse, Ph. D., Associate Scientist II, with the collaboration of Florencio Vázquez, Ph. D., Research Associate; Peter Paraskevoudakis, Ph. D., Associate Scientist; Francis K. S. Koo, Ph. D., Associate Scientist.

DATE INITIATED: May, 1962

PURPOSE AND SCOPE:

This project deals with the question: What are some of the unique effects of ionizing radiation of matter? To this end, the biological and chemical effects of x-radiation in the 5-20 Kev energy range have been studied. This energy region is of considerable importance since it contains the K-absorption edges of the constituent atoms of most living systems.

CURRENT STATUS:

Earlier work dealt with the metalloenzyme catalase, for which greatest biological effect (inactivation) was found with x-rays of energy at or near the K-absorption edge of the constituent iron. In the present period, studies were extended to the metalloenzyme carboxypeptidase A and its related esterases. In these enzymes, the constituent metal can be removed by dialysis and then replaced by certain other metals. Accordingly, the original zinc-containing enzyme can be converted to esterases containing cobalt, nickel, tin, cadmium, mercury, or molybdenum. A series of such enzymes, identical in composition except for the metal, are being irradiated with monochromatic x-rays of energies corresponding to the various metal K-absorption edges.

The biological studies of such x-ray effects have been extended into the area of genetics. Chromosomes in onion root tissue were labeled with a nucleic acid analog, 5-bromodeoxyuridine, and then irradiated with x-rays at, above, and below the K-absorption edge of bromine. Preliminary results indicate that chromosome aberrations in the cell nucleus occur with highest frequency after irradiation at energies equal to or greater than the K-absorption edge of bromine.

In related work, effort is being directed to the effects of such monochromatic, low energy x-rays on inorganic crystals, since these crystals serve as excellent models for the more complex and less clearly defined biological macromolecules. Study of the production of color-centers in alkali halide crystals irradiated by such radiation is underway.

PUBLICATIONS:

"Resonance in Radiation Effects", Gomberg, H. J., Luse, R. A., and Vázquez Martínez, F., Technical Report No. 1, PRNC-12, 1963.

"Resonance in Radiation Effects", Gomberg, H. J., Luse, R. A., and Vázquez Martínez, F., Progress Summary Report No. 1, PRNC-14, 1963.

"Resonance in Radiation Effects of Low Energy Monochromatic X-rays on the Metalloenzyme Catalase", Gomberg, H. J., and Luse, R. A., presented at Radiation Research Society Meeting, Milwaukee, May, 1963.

"Resonance in Radiation Effects", Technical Report No. 2, PRNC-40, 1964.

"F-Center Production with Monochromatic X-rays", Vázquez Martínez, F., presented at Conference of Nuclear Spectroscopy and Solid State Physics, Lima, Perú, February, 1964.

"Resonant Action of Low Energy Monochromatic X-rays on Chromosomes Incorporated with 5-Bromodeoxyuridine", Koo, F.K.S., and Gomberg, H. J., Radiation Research (in press).

RADIOTHERAPY AND CANCER DIVISION

TITLE: Radiotherapy and Cancer Division

STAFF: Victor Marcial, M.D., Chief Scientist II, Head; José M. Tomé, M.D., Chief Scientist I; Jeanne Ubiñas, M.D., Associate Scientist II; José N. Correa, M.D., Associate Scientist II; Antonio Bosch, M.D., Associate Scientist II; Graciela Maytorena Serna, M.D., Associate Scientist II; Maria P. de Lozano, M.S., Research Associate I; Zenaida Frias, M.S. Research Associate I.

DATE INITIATED: 1958

PURPOSE AND SCOPE:

The main purpose of this Division is to train physicians and allied personnel in all aspects of the application of nuclear energy to cancer. A second purpose is to develop and carry out a research program to improve our knowledge in the cancer and radiation fields.

CURRENT STATUS:

This Division offers two programs in Radiotherapy Training:
(A) Radiotherapy Residency Program. The objective of this program is to prepare qualified radiation therapists. This is an approved program that fulfills the requirements of the American Board of Radiology. Physicians with a year of internship or equivalent clinical experience are accepted for this training. The total training period lasts three years, but trainees are required to take an additional fourth year of supervised practice (preceptorship) before admission to the specialty examinations. Trainees learn: to diagnose cancer, to determine the extent and radiosensitivity of the tumor, to choose the appropriate treatment, and to plan and conduct radiological therapy.

(B) Special Short Term Radiotherapy Training Course. Special programs are prepared according to the needs of the person. Participants may engage in a research project and may participate in all teaching activities of the Radiotherapy and Cancer Division; but are not given patient responsibility.

To complement the training programs, a number of research projects are active in this Division. These include: (1) Carcinoma of the Cervix Uteri in Sterilized Women; (2) Study of Fractionation of Weekly Doses in Cancer Patients Submitted to Irradiation; (3) Carcinoma of the Cervix Uteri Associated with Pregnancy; (4) Bio-chemical Changes in the Blood of Patients Receiving Radiotherapy for Cancer-Serum Lipids, Serum Sodium and Potassium, and Urea; (5) Study of Optimal Tumor Dose in Radiation Therapy of Cancer of the Esophagus; (6) Controlled Study of the Split-Dose

Technique in Radiotherapy of Cancer; (7) Study of Chromosome Changes in Patients Undergoing Radiation Therapy for Cancer; (8) Lymphangiography in Cancer Patients.

PUBLICATIONS:

Panel Discussion on Mediastinal Tumors with Presentation of Cases, V. A. Marcial, M.D., "Boletín de la Asociación Médica de Puerto Rico", Vol. 50, No. 10, October 1958

"Abdominal Tumors in Children", (Symposium with presentation of Cases), V. A. Marcial, M.D., R.A. Marcial Rojas, M.D. E. Mirabal, M.D., R. Díaz Bonet, M.D., L.A. Díaz Bonet, M.D. Published in "Boletín de la Asociación Médica de Puerto Rico", Vol. 51, No. 11, November 1959

"Carcinoma of the Base of the Tongue", V. A. Marcial, M.D., American Journal of Roentgenology 81, No. 3, 420-429 (1959)

Symposium on Tumors of Bone, V. A. Marcial, M. D., R. A. Marcial Rojas, M.D., F. Díaz Bonet, M.D., J. Dávila López, M. D. E. Pérez Santiago, M.D., published in "Boletín de la Asociación Médica de Puerto Rico", Vol. 51, No. 2, February 1959

"Cancer Morbidity in Puerto Rico", V. A. Marcial, M. D., Acta Unio Internationales Contra Cancrum, July 1960

"Socio-economic Aspects of the Incidence of Cancer in Puerto Rico", V.A. Marcial, M.D., Annals of the New York Academy of Sciences, December 1960

"Carcinoma of the Penis", V.A. Marcial, M.D., et. al., published in Radiology, August 1962; The Medical Association Bulletin, January 1963

"Our Cancer Problem", V. A. Marcial, M.D., "Boletín de la Asociación Médica de Puerto Rico", October 1962

"Two Years Experience in Exfoliative Cytology in Puerto Rico", V. A. Marcial, M.D., O. García Ramírez, M.D. and S. A. Forster, M.D., "Boletín de la Asociación Médica de Puerto Rico", Vol. 54, No. 9, pages 289-293, September 1962

"Cancer Control in Puerto Rico", V. A. Marcial, M.D., Radiología Clínica 33:39-46 (1964)

NUCLEAR POWER PROGRAM OF PUERTO RICO WATER RESOURCES AUTHORITY

TITLE: Nuclear Power Program of Puerto Rico Water Resources Authority

DATE INITIATED:

Early in 1955, the Puerto Rico Water Resources Authority became interested in the development of nuclear power for central station application. Personnel education and review of reactor concepts were initiated at that early date.

Contract negotiations for a power reactor, utilizing the boiling water with integral steam superheat concept, were begun in 1958. A construction contract for a boiling water reactor with integral steam superheat was signed early in 1960.

A new nuclear plant, 200,000 kw in size initially, is presently being planned for the Metropolitan Area. Bids will be opened in February, 1965.

A combined nuclear and desalination plant is being considered for the South Coast Station.

PURPOSE AND SCOPE:

The purpose of the program is to produce electric power at lower costs.

CURRENT STATUS:

The BONUS Plant is undergoing tests and will be operational within six months.

The new nuclear plant is in the bidding stage. Specifications were prepared and issued last October, 1964. Bids will be opened in mid February, 1965.

The combination, nuclear power and desalination plant is being considered. No detailed work or consideration has been given yet pending on economic support from other interested parties.

PUBLICATIONS:

There are many publications concerning the BONUS Plant among which are: "The Summary Design Report" and "The Final Hazard Summary Report".

Specifications were prepared and issued to prospective bidders for the new 200,000 kw nuclear unit. No publication has been made for the desalination project.

CIVIL DEFENSE IN PUERTO RICO

TITLE: Civil Defense in Puerto Rico

PURPOSE AND SCOPE:

The Office of the Civil Defense of the Commonwealth of Puerto Rico operates directly from the Office of the Governor. It derives its authority and procedural guidance from appropiate Federal legislation and specifically from Puerto Rico Public Law 183, 1 May 1951, as ammended by the legislature of the Commonwealth.

For the purposes of National supervision and guidance, Puerto Rico is located in Region One, Office of Civil Defense. Regional Offices at Harvard, Massachusetts exercise this guidance and supervision over the New England States, New York, New Jersey and the Virgin Islands, in addition to the Commonwealth of Puerto Rico.

Locally, the Office of Civil Defense is organized into a Central Office and seven Districts, or Zone Offices. The Central Office is located in the Metropolitan Area; the Zone Offices are strategically situated in Arecibo, Aguadilla, Mayaguez, Ponce, Guayama, Humacao and San Juan. The Zone Directors, in representation of the Director, supervise the Civil Defense activities of the Local Directors of the seventy-six political subdivisions of the Commonwealth.

Each Federal and Commonwealth Government Agency assigns a Civil Defense Coordinator to the Central Office. The Governor of Puerto Rico designates a Personal Representative in each Municipality, normally a Government Agency Official, to insure the full implementation of the Civil Defense mission in case of need.

The mission of the Office of Civil Defense is that of safeguarding the life and property of the citizens of Puerto Rico, and of reducing or precluding the damages which may be caused by enemy action, natural disaster or nuclear detonations. Specifically as concerns nuclear effects, the Civil Defense established the following objectives:

1. A program of community fallout shelters, stocked to sustain life and health throughout the attenuation phase of radioactive emanations. This program is supplemented by the family and rural shelter programs.

2. An island-wide program of alert systems, early warning and communications networks, supplemented by alternated warning and communications methods which include amateur short wave length radio operators.

3. A program of public information and education, creating thereby new habits of life; which include adult education, medical self help, shelter administration and radiological defense measures.

Working in close cooperation with the Office of Emergency Planning, as well as other Federal and Commonwealth Agencies, the Office of Civil Defense plays an important role in natural disaster threat or occurrences. It participates by directing and coordinating the rescue, recovery and survival operations of the community, in insuring the continuity of established government and in the judicious utilization of available resources.

Civil Defense is an essential element of our national security program. In Puerto Rico, the average citizen has become conscious of the continuing requirement for this concept of non-military defense against disaster, either natural or man-made.

CLINICAL APPLICATIONS DIVISION

TITLE: Clinical Applications Division

STAFF: Sergio Irizarry, M.D., Chief Scientist II, Head; Aldo E. Lanaro, M.D., Associate Scientist II.

DATE INITIATED: 1958

PURPOSE AND SCOPE:

The main purpose of the program of this Division is teaching and training of Latin American physicians in the diagnostic and therapeutic uses of radioisotopes in humans.

CURRENT STATUS:

(A) During the past six months, 1,900 diagnostic procedures were performed on 1,184 patients from the University Hospital, the San Juan City Hospital, The Rio Piedras Municipal Hospital, the I. González Martínez Oncologic Hospital and other referring sources making up a total of 13 different sources that provide our patient load, for an average monthly diagnostic and patient load of 316.6 and 197 respectively. This service load is adequate for our training program.

(B) Courses Available:

Basic Course Clinical Applications of Radioisotopes. This course consists of formal lectures, demonstrations, periods of discussions and laboratory work. Its main purpose is to emphasize training in the use of clinical radioisotopic techniques.

Orientation Course Clinical Applications of Radioisotopes for Medical Residents. This is a non credit semester course for Medical Residents designed for orientation only in the medical uses of radioisotopes.

Orientation Course Clinical Uses of Radioisotopes for Medical Practitioners. This is a course for general practitioners and doctors in other medical specialities, designed for orientation only in the medical uses of radioisotopes.

Advanced Course in a Medical Specialty. This is a course emphasizing the application of Nuclear techniques in a special field of Medicine. A course is being set up to be given next June in the field of Renal Diseases.

Training in Clinical Research. This course stresses research aspects in Clinical Medicine, and is designed to provide research facilities to trainees interested in clinical radioisotopes research work.

(C) Research. To complement the training program the following research projects in the areas indicated are active:

Thyroid Research Program: Clinical Studies of Thyroid Function. (a) In vitro tests of thyroid function; (b) Anticonceptives and thyroid uptake of I-131; (c) Evaluation of the 24 hour I-131 Thyroid Uptake; (d) Correlation thyroid scan with Histopathology; (e) 24 to 48 hour I-131 uptake and tagged hormones.

Cardiovascular and Renal Research Program: Clinical and Radioisotope Studies of Cardiovascular and Renal Systems. (a) Renogram in Cancer of the Cervix; (b) Cardiovascular and Renal States in Diabetics; (c) Renal function.

Gastrointestinal Tract and Liver Research Program: Evaluation of gastrointestinal and hepatic functions. (a) Radiotherapy and Intestinal Absorption. Phase 1 - during radiation. Phase 2 - after radiation; (b) Thyroid Gland as indicator of intestinal absorption; (c) Rose Bengal I-131 localization and dynamic studies.

Isotopic Localization Research Program: Tumor Localization and Improvement of Scanning Apparatus. (a) Combined X-ray photo-scanning unit; (b) Organ and tumor localization.

Radioisotope Therapy Research Program: Review of Patients treated with I-131.

PUBLICATIONS:

"Renogram in Cancer of the Cervix", S. Irizarry, M.D., A. L. Rodríguez Rosado, M. D., PRNC-33.

AGRICULTURAL BIO-SCIENCES DIVISION

TITLE: Agricultural Bio-Sciences Division

STAFF: Robert A. Luse, Ph.D., Associate Scientist, Head; Duane B. Linden, Ph.D., Associate Scientist II; Francis K. S. Koo, Ph.D., Associate Scientist II; Andrew Maretzki, Ph.D., Associate Scientist; David W. Walker, Ph.D., Associate Scientist; J. Roldan, Research Associate I.

DATE INITIATED: 1960

PURPOSE AND SCOPE:

(A) Education and Training

1) Aim: to train students in nuclear techniques which are used in agriculture (and the closely related fields of plant physiology, genetics, and agricultural biochemistry)

2) Staff offers courses which support advanced work: Cytogenetics, Advanced Genetics, Biochemistry of the Cell

3) Staff offers advanced courses in nuclear field: Nuclear Techniques in Biological Research, Radiobiology, and Special Problems in Nuclear Biology

4) M.S. program in either Agriculture or Biology includes formal class work (30 hours) and research thesis

(B) Research

1) Effects of ionizing radiation on the genetics, physiology, and biochemistry of plants which are important economically in the tropics.

Luse: Can a high-sucrose mutant be produced through neutron irradiation of sugarcane seed material? A biochemical mass-screening technique is in operation. Over 500 plants grown from irradiated buds are now 4 to 7 mos. old.

Koo: What are the cytogenetic effects of neutron irradiation in sugarcane?

Maretzki: What are the biochemical pathways of sucrose formation and degradation in sugarcane and how do these differ in mutants produced by neutron irradiation? Enzyme levels have been determined and kinetics are under study.

Linden: What is the radiation response of the genetic phenomenon of paramutation? Both regulator gene and site of action found radiosensitive in maize. Phenotypic alterations have persisted for two generations. Paramutation is hypothesized as an inactivation event, not true mutational change.

2) Application of radicisotopes in the study of tropical plant and soil relationships, so as to improve agronomic practices?

Padovani: Calcium and strontium uptake by plants grown in pure and mixed stand

Roldan: Application of isotope techniques to standard fertilization practices and to micro-nutrient deficiencies.

3) Preservation of tropical fruits and vegetables by radiation pasteurization.

Linden: Gamma radiation at 200Kr level extended shelf life of mangos for 30 days at 50°C storage.

Graham: To study changes in vitamin levels in gamma-irradiated mangos.

(C) Cooperative programs

1) Service gamma irradiation with Cobalt-60 source

Linden, Cuevas: Several hundred samples irradiated last year.

2) US-AEC Exhibit in Central America

Staff serve as agricultural consultants.

PUBLICATIONS:

"A Mechanism for Radiation-Induced Back Mutation", F.K.S. Koo, Second International Congress of Radiation Research, Abstract, p. 234, Aug., 1962.

"Biological Effect Produced by X-Rays and Thermal Neutrons in Diploid and Hexaploid Species of Avena", F.K.S. Koo, Radiation Botany, (2) 131-140, (1962).

"Growth of Sterile Plant Roots in Sand or Soil in an Inexpensive Growth Chamber", R.A. Luse, Soil Society of America Proceedings, (26) 406-408, July-August, 1962.

"Nutritional Factors Stimulating the Formation of Lysine Decarboxylase in Escherichia Coli", A. Maretzki and M.T. Mallete, Journal of Bacteriology (83) 720-726, April, 1962.

"Polygenic Variability Induced by Thermal Neutron Irradiation", F.K.S. Koo, Radiation Research (16) 501, Abstract, 1962.

"Additional Sources in Paramutation Induced Ability", D.B. Linden, Genetics (48) July, 1963.

"Effects of Radiation on Paramutation", D.B. Linden, Radiation Research (19) May, 1963.

"Mechanism of Enzyme Inactivation by Ultraviolet Light and the Photochemistry of Amino Acids", R.A. Luse and A.D. McLaren, Photochemistry and Photobiology, (2) 343-360, Aug. 1963.

"Synergistic Effect of 5-Bromodeoxyuridine and Gamma Rays on chromosomes", F.K.S. Koo, Science, July 19, 1963.

"Agricultural Applications of the Puerto Rico Nuclear Center Co^{60} Gamma Irradiation Facility", J. Cuevas and D.B. Linden, presented at Caribbean Food Crops Society meeting, Barbados, October, 1964.

"Radiation Pasteurization of Mangos", D.B. Linden, ibid.

"Effects of Co^{60} Gamma Irradiation on Corn Pollen", V. Rodríguez and D.B. Linden, J. Agric. Univ. P. R., in press.

"Some Aspects of Ascorbic Acid Biosynthesis in the West Indian Cherry", A. Maretzki (with C.F. Asenjo), presented at Third Caribbean Chemical Symposium, Caracas, January, 1965.

RADIOISOTOPES DIVISION

TITLE: Radioisotopes Division

STAFF: Edwin Roig, Ph.D., Chief Scientist II, Head; H. Harry Szmant, Ph.D., Chief Scientist II; Malcolm Daniels, Ph.D., Associate Scientist II; José Castrillón, Ph.D., Associate Scientist I; Rosa Santana de Tirado, M.S., Research Associate I

DATE INITIATED: August 19, 1957

PURPOSE AND SCOPE:

The main objective of the program is the offering of sufficient training to scientists in the application of radioisotopes and ionizing radiation to the physical sciences to provide technical competence for their future work. A second objective is the offering of introductory training to scientists, irrespective of their fields of interest, in radioisotopes and ionizing radiation as a background or as complementary preparation for their participation in other programs of PRNC.

CURRENT STATUS:

(A) Courses receiving University credit:

Basic Course in Radioisotope Techniques (Biochemistry and Nutrition 410 - 2 credit hours). Four week course now being offered four or five times a year. We have had a total of 250 participants (33 sessions) including 61 Latin Americans. The present rate of participants is approximately 20 per year.

Radiochemistry Course (Chemistry 465 - 4 credit hours). A one semester course offered once a year for advanced undergraduate and graduate students. Approximate enrollment: 4 to 6.

Nuclear Techniques in Biological Research (Biology 372 - 4 credit hours). A one semester course offered once a year for advanced undergraduate students. Approximate enrollment: 4 to 6.

Radioisotope Applications in Organic Chemistry (4 credit hours). A one semester graduate course to be offered for the first time this coming year. The Radiochemistry course mentioned above is a prerequisite.

(B) Courses for special training:

Radiological Physics. A special course offered when requested to M.D. Residents in Radiology.

PUBLICATIONS:

The lecture material used in the Basic Course in Radioisotope Techniques is being compiled and will be published in two volumes.

ORGANIC CHEMISTRY RESEARCH PROJECT

TITLE: Organic Chemistry Research Project

INVESTIGATORS: H. Harry Szmant, Ph.D., Chief Scientist II, Principal Investigator; José Castrillón, Ph.D., Associate Scientist I; and 11 Research Assistants and Graduate Students. Certain parts of the Project count with the collaboration of Edwin Roig, Ph.D., Chief Scientist II; and recently, with Dr. Seymour S. Block, Oak Ridge Research Participant.

DATE INITIATED: September, 1961

PURPOSE AND SCOPE:

The purpose of the program is to provide advanced chemical training through participation in individual research projects. The projects cover a relatively wide range of subjects in order to offer a broad experience to all members of the group, and the diffusion of the varied aspects of organic chemistry is promoted by group seminars and discussions.

CURRENT STATUS:

The current research projects cover the following areas:

(A) The study of organic sulfur compounds with special emphasis on the physical and chemical properties of sulfoxides, i.e. self-association, hydrogen bonding formation, reduction by phosphorus compounds, formation of metallic chelates, stereochemistry, etc.

(B) Nucleophilic substitution reactions of imidates (NIH) are investigated with the purpose of developing a selective replacement of a hydroxyl group in polyhydroxyl compounds.

(C) The study of organic boron compounds aims to develop compounds suitable for neutron activation therapy.

(D) The study of solvent effects in organic chemistry includes the remarkable effect of dimethyl sulfoxide on the kinetics of the Wolff-Kishner reaction, the solvation of the monosodium salt of phenolphthalein, the stabilization of carbanions in dimethyl sulfoxide, etc.

PUBLICATIONS:

"Rearrangements During Oxidation of 1,1-Diarylethanes", H. H. Szmant and J. F. Deffner, J. Am. Chem. Soc., 81, 9558 (1959)

"Cyclic Derivatives of Diboron and Glycols", Honor Program Thesis, August, 1963.

"The Base-Catalyzed Formation of Imidates" by H. H. Szmant and E. P. Olavarría, PRNC-20 and M.S. Thesis of E.P. Olavarría, August, 1963

"The Wolff-Kishner Reaction of Hydrazones" by H. H. Szmant and C. M. Harmuth, J. Am. Chem. Soc., 86, 2909 (1964).

"A Study of the Reaction of Triphenyl Phosphine and Sulfoxides", M.S. Thesis of O. Cox, August, 1964.

"The Reduction of Sulfoxides by Triphenyl Phosphine and Carbon Tetrachloride", H. H. Szmant and J. Castrillón, J. Org. Chem., in press.

"The Self-Association of Dimethyl Sulfoxide", R. Figueroa, E. Roig, and H. H. Szmant, Spectroch. Acta, in press.

PHOTOCHEMISTRY AND RADIATION CHEMISTRY PROJECT

TITLE: Photochemistry and Radiation Chemistry Project

INVESTIGATORS: Malcolm Daniels, Ph.D., Associate Scientist II; Alec Grimison, Ph.D., Associate Scientist, Ad-Honorem; Eric Wigg, Ph.D., Research Associate, Ad-Honorem.

DATE INITIATED: NIH support March 1, 1962; USAEC Division of Biology and Medicine support, January, 1963.

PURPOSE AND SCOPE:

(A) Investigation of role of excitation processes in radiation chemistry of aqueous solutions.

(B) Investigation of modes of decomposition of characteristic excited states.

(C) Investigation of nature and reactivity of excited states of D.N.A. and its constituents in aqueous solution.

CURRENT STATUS:

(A) Photolysis of Aqueous Thymine Solution of 1849Å has been shown to occur with high quantum yield in the presence of oxygen and leads to formation of hydroxyhydroperoxide (found in radiolysis), glycol and hydrogen peroxide. The process is interpreted in terms of (1) scavenging of water photolysis by thymine, and (2) direct photolysis of the higher excited state of thymine. This work has been concluded; a preliminary account has appeared and a full presentation is in preparation.

(B) Extensive work has been carried out on the photolysis of nitrate at 313 mu in aqueous solution i.e. via the $n \rightarrow \pi^*$ excited state. The effects of concentration, intensity, pH, and oxygen have been investigated, as well as the inhibition by nitrate, and scavenging arsenite, hydrogen peroxide and ethanol. This work, which is of immediate relevance in interpreting the "direct effect" in the radiolysis of nitrate solutions, is being concluded and prepared for publication.

(C) The luminescence of aqueous solutions of heterocyclic components of D.N.A. has been investigated. A previously unreported luminescence from cytosine has been characterized. Similar work has been carried out on thymine and adenine. Cytosine has been found to undergo a biologically important photochemical deamination at 2537Å. The kinetics of deamination have been determined and correlated with the kinetics of self-quenching of

luminescence. Analysis of the data suggests that both effects originate in a triplet state of cytosine. Irradiation of cytosine/thymine mixtures has produced evidence for energy transfer; a luminescence has been observed from D.N.A. in aqueous solution, and deamination is found to occur at 2537Å.

This work is being actively prosecuted; a preliminary account has been presented at the International Congress of Photobiology, Oxford, 1964, and other aspects are scheduled for the Biophysical Society Meeting, Feb. 1965.

PUBLICATIONS:

"The Radiation Chemistry of Arsenite, Pt. II. Oxygen-Free Solution", M. Daniels, J. of Phys. Chem. 66, 1475 (1962)

"Photochemically-Induced Oxidation of Arsenite: Evidence for the Existence of Arsenic (IV)", M. Daniels, J. of Phys. Chem. 66, 1473 (1962)

"Photochemistry of Thymine", M. Daniels and Alec Grimison, Nature, 197, 484 (1963)

"The Deuterium Isotope Effect in the Hydrogen Bonding of Imidazole in Naphthalene Solutions", Alec Grimison, J. of Phys. Chem. Vol. 962 (1963)

"Fluorescence of Cytosine in Aqueous Solutions", M. Daniels and Alec Grimison, PRNC 42, July 1964

"The Photochemical Deamination of Cytosine at 2537Å", M. Daniels and Alec Grimison, Biochem. and Biophys. Research Communication 16, 428 (1964)

"Radiation Chemistry of Arsenite Solutions, Pt. III. Effect of Arsenite Concentration in Oxygen-Saturated Solution", M. Daniels, J. Phys. Chem. 68 1867 (1964)

MARINE BIOLOGY PROGRAM

TITLE: Marine Biology Program

INVESTIGATORS: Frank G. Lowman, Ph.D., Chief Scientist I, Principal Investigator; Robert A. Stevenson, Ph.D., Associate Scientist I; D. K. Phelps, Ph.D., Associate Scientist I; Enrique Avila, M.S., Research Associate I; Total Research Staff - 15 members.

DATE INITIATED: January, 1962

PURPOSE AND SCOPE:

Although the research is comprised of five major projects as well as supporting areas of investigation, it functions as an integrated research program. The investigations were designed to measure the distribution and movements of selected trace elements in a restricted but complete ecological and biogeochemical system and to measure the biological and environmental factors which influence the distribution patterns of the elements.

CURRENT STATUS:

Specifically, the distributions of selected trace elements are being measured in minerals, rocks, and soils of a river watershed into the river waters and sediments, into the marine waters at depths and distances offshore, through the marine biosphere and into the marine sediments. To obtain information on the interactions of the marine biosphere and hydrosphere, measurements are being made of (1) rates of photosynthesis (productivity), (2) effects of the rates of photosynthesis upon uptake of trace element by phytoplankton, (3) biological half-lives for trace elements, (4) structures of food webs and (5) relative transfer of carbon, nitrogen, and trace elements through trophic levels of food webs. The effects of physical and chemical oceanographic conditions upon the distributions of trace elements and organisms are being investigated with special emphasis placed on observations of the effects of varying amounts of mineral-rich silt upon the distribution patterns of benthic marine organisms. The research projects include: (1) measurements of biological productivity, (2) analysis of trace elements, (3) measurements of concentration factors of organisms for selected radioisotopes, (4) measurements of fallout and natural radioisotopes in marine samples and (5) physical and chemical oceanographic measurements. All phases of the work are in progress. In addition, ecological studies, including food web investigations, are being done.

PUBLICATIONS:

"Marine Biology - Progress Summary Report I", F. G. Lowman, PRNC 15, (1963).

"Activation Analysis in Marine Biology", F. G. Lowman, International Atomic Energy Agency - Proceedings of the Study Group Meeting on the Utilization of Research Reactors held at Sao Paulo, Brazil, Nov. 4-8, 1963.

"Trace Element Analysis of Some Marine Organisms", by R. A. Stevenson, S. Lugo Ufret, and A. T. Diecidue, International Atomic Energy Agency - Proceedings of the Fifth Inter-American Symposium on the Peaceful Application of Nuclear Energy, Valparaiso, Chile, March 9-13, 1964.

"Investigations in Trace Element Distribution in Marine Waters and Sediments", F. G. Lowman, L. Quiñones, M. Miró, I. Oliver de Padovani, E. Ramos, V. Román de Vega and H. J. Bielen, International Atomic Energy Agency - Proceedings of the Fifth Inter-American Symposium on the Peaceful Application of Nuclear Energy, Valparaiso, Chile, March 9-13, 1964.

"Neutron Activation Analysis for Scandium", M. Miró, et al, to be submitted to Analytica Chimica Acta.

"Scandium Analysis in Sea Water", V. Román de Vega, et al, to be submitted to Journal of Marine Research.

SUGAR CANE BORER PROJECT

TITLE: Induced Sterility for Population Control of the Sugar Cane Borer (Diatraea Saccharalis, Crambidae Lepidoptera) in Puerto Rico

INVESTIGATOR: David W. Walker, Ph.D., Associate Scientist II.

DATE INITIATED: Project initiated by Dr. Howard J. Teas, August, 1961, continued under direction of Dr. D. W. Walker from April, 1962.

PURPOSE AND SCOPE:

The objective is to determine if the sugar cane borer can be suppressed or irradicated by mass-release of irradiated males or females. To accomplish this objective it has been necessary to investigate mass-rearing methods and to aid cooperators at the Commonwealth Experiment Station and USDA in the development of a full medium suitable for mass-rearing. Other information has been collected on oviposition, longevity of adults, mating behavior and factors pertinent to a fuller understanding of the biology of this species.

CURRENT STATUS:

(A) Results of irradiation tests (preliminary tests): (1) Exposure to 20-40 KR renders virgin male adult borers sterile by sperm death, sperm inactivation and/or lethal dominants. (2) Exposure to 18-40 KR render virgin female adult borers sterile by oocyte damage and/or dominant lethality. (3) Egg production is not affected by irradiation of adult females or males. (4) Life span of adults is not affected by exposure of 70 KR and below. (5) Exposures to 8 KR, 10 KR, 12 KR and higher, cause 50% mortality and higher to larval status and pupae of less than 5 days of age. Lethal dosage and sterilizing dosage are equal in immature status.

(B) Artificial rearing food media have been developed which prolonged adult life span 30%, increased egg production 10%, shortened larval growth time 25%, and permitted survival from egg to adult above 90%. The most promising food media being tested will provide adults at a cost of less than 1/5¢ each for ingredients.

(C) Mating behavior. Mating takes place in the dark and under laboratory conditions newly emerged adults will mate at any time if placed in the dark. In nature, mating takes place as early as 8:00 p.m. and until 4:00 a.m. The female attracts the male by a chemical sex attractive (pheromone) secreted by glands on the ventral side of the eighth abdominal segment. Male searches for female by an erratic flight pattern. Upon locating the female, a brief courtship behavior ensues and is followed by copulation.

(D) Work in progress includes: (1) Development of mass-rearing methods and includes food medium of lower costs. (2) Development of a hybrid line of this species having short larval life span, long adult life span, higher vigor, and higher reproductive potential. If possible, a line will be selected which is sufficiently different so that released individuals can be easily distinguished from naturally occuring individuals (in the fields).

(E) Future work will include: (1) Intensive tests to precisely determine irradiation effects on male sterility. Specifically to determine the feasible dose for treating males for field release and the type of effect produced on male (sperm death, sperm inactivation and lethal dominants). (2) A study of the effectiveness of treated males for competing with normal males for mates under laboratory and field conditions. (3) A study of laboratory and field population reduction during and after release of irradiated males.

PUBLICATIONS:

"Biology of Diatraea Saccharalis (FAB.) in Puerto Rico III Oviposition Rate", D. W. Walker, and M. Figueroa, Annals Entom. Soc. of Amer. 57 (4): 515-516, (1964)

"Biology of Diatraea Saccharalis (FAB.) I. A description of the mating behavior", D. W. Walker, Proc. Entom. Soc. of Wash., to appear March, 1965.

BUGHER, JOHN C.
Director, Puerto Rico Nuclear Center
Professor of Pathology

FIELD: Pathology

EDUCATION: B.S., Taylor University, 1921; A.B., University of Michigan, 1921; M.D., University of Michigan, 1929; M.S. University of Michigan, 1931; Hon. Sc.D., Taylor University, 1953; Hon. Sc.D., University of Michigan, 1964.

EXPERIENCE: Instructor, Mathematics and Physics, Taylor University, 1919-20; Assistant in Bacteriology, University of Michigan, 1922-26; Director, Public Health, South Haven, Michigan, 1926-28; Senior Instructor, Pathology, University of Michigan, 1929-32; Assistant Professor, Pathology, University of Michigan, 1933-37; Rockefeller Foundation's Yellow Fever Laboratory, Colombia, 1937-43; Director, Yellow Fever Institute, Lagos, Nigeria, West Africa, 1943-48; Biophysical Studies of Viruses, Rockefeller Foundation Laboratories, New York, 1949-51; Deputy Director, Division of Biology and Medicine, U.S. Atomic Energy Commission, 1951-52; Director, 1952-55; Director, Medical Education and Public Health, Rockefeller Foundation, 1955-59; Consultant on Nuclear Energy Affairs, 1959-60; Director, Puerto Rico Nuclear Center, July 1960 to present*; General Advisory Committee to the U.S. Atomic Energy Commission, May 1, 1964 to present.

* Dr. Bugher is on loan to Puerto Rico Nuclear Center from Rockefeller Foundation.

COBAS, AMADOR
Associate Director, Puerto Rico Nuclear Center
Professor of Physics

FIELD: Physics

EDUCATION: B.A., (Physics), University of Puerto Rico, 1931; Graduate work in Physics including course on Radioactivity under Madame Curie, 1933; M.A. (Physics), Columbia University, 1940; Ph.D. (Physics), Columbia University, 1944.

EXPERIENCE: Assistant Instructor Physical Sciences, University of Puerto Rico, 1936; Instructor Physical Sciences, University of Puerto Rico, 1937-39; Resident Fellow, Columbia University, 1939-40; Assistant Professor of Physics, University of Puerto Rico, 1940-44; Lecturer in Physics, Columbia University, 1941-43; Associate Professor of Physics and Head Department of Physics, University of Puerto Rico, 1944-47; Professor of Physics and Head Department of Physics, University of Puerto Rico, 1947-49; Research Associate, New York University, 1947-49; Professor of Physics and Dean Faculty of General Studies, University of Puerto Rico, 1949-50; Professor of Physics and Director Cosmic Ray Project, University of Puerto Rico, 1950-56; Visiting Professor, New York University, 1952-53; Professor of Physics and Director Radioisotope Applications, University of Puerto Rico, 1956-60; Associate Director, Puerto Rico Nuclear Center, 1960 to present.

DANIELS, MALCOLM
Radiation Chemistry & Photochemistry Project
Radioisotopes Division
Associate Scientist II

FIELD: Chemistry

EDUCATION: B.Sc., King's College, University of Durham, England, 1948-51; Doctorate King's College, University of Durham, England, 1951-55.

EXPERIENCE: Research Assistant in Radiation Chemistry and Photochemistry of aqueous solutions, King's College, University of Durham, 1954-57; Resident Research Associate at Argonne National Laboratory, Illinois, 1957-60; Visiting Scientist in Radiation Chemistry, Brookhaven National Laboratory, July-September, 1960; Lecturer in Chemistry, University College of the West Indies, Kingston, Jamaica, 1960-62; Associate Scientist, Radioisotopes Division, Puerto Rico Nuclear Center, 1962 to present.

GOMBERG, HENRY J.
Deputy Director, Puerto Rico Nuclear Center
Professor of Physics

FIELD: Electrical Engineering

EDUCATION: B. S., City College of New York; M.S.E., (Electrical Engineering), University of Michigan, 1942; Ph. D. (Electrical Engineering), University of Michigan, 1951.

EXPERIENCE: Detecto Scales, 1936-37; General Switch Corporation, 1937-41; Instructor and Research Associate on High Frequency Electrical Energy, 1941-43; Civilian and Officer, Naval Ordnance Laboratory, 1943-45; Assistant Professor, Associate Professor, Professor and Chairman of Department of Nuclear Engineering, University of Michigan, 1946; Research Associate, Laboratory Supervisor, Assistant Director, Director, Michigan Memorial Phoenix Project on Peacetime Atomic Energy, 1946; Consultant to: Argonne National Laboratory-Reactor Division and Remote Control Division, U. S. Atomic Energy Commission Office of Isotope Development, International Co-operation Administration, U. S. Department of State, Oak Ridge Institute of Nuclear Studies and World Health Organization; Professor of Physics, University of Puerto Rico, 1961 to present; Deputy Director, Puerto Rico Nuclear Center, 1961 to present.

IRIZARRY RIVERA, SERGIO
Head, Clinical Applications Division
Chief Scientist II
Clinical Associate in Medicine

FIELD: Internal Medicine

EDUCATION: B.S., University of Puerto Rico, 1946; M.D., University of Buffalo, 1950.

EXPERIENCE: Intern at Bayamón District Hospital, 1950-51; Medical Resident, Fajardo District Hospital, 1951-52; Physician, Health Centers at Río Grande, Vega Baja, Rincón, Corozal, Department of Health, 1952-53; Physician, Puerto Rico Cancer League, 1953-56; Radiotherapy Resident, Dr. I. González Martínez Oncologic Hospital, 1956-58; Clinical Fellow, Internal Medicine in Cancer, Frances Delafield Hospital, 1958-60; Clinical Associate in Medicine, University Hospital, 1960 to present; Assistant Attending, San Juan, City Hospital, 1960 to present; Internist, Dr. I. González Martínez Oncologic Hospital, 1960 to present; Head, Clinical Applications Division, Puerto Rico Nuclear Center, 1960 to present.

LOWMAN, FRANK G.
Director, Marine Biology Program
Chief Scientist I

FIELD: Radiobiology

EDUCATION: B.S., University of Washington, 1948; Ph.D. (Marine Biology) University of Washington, 1956.

EXPERIENCE: Research Assistant, Laboratory of Radiation Biology, 1948-53; Assistant Professor, Laboratory of Radiation Biology, 1953-58; Associate Professor, Laboratory of Radiation Biology, 1958-61; Field Leader, air sampling teams, Nevada Test Site, 1951-52; Group leader, Oceanographic surveys, Eniwetok Test Site, 1958; Associate Scientist, Agricultural Bio-Sciences Division, Puerto Rico Nuclear Center, 1961-62; Chief Scientist I, Marine Biology Program, Puerto Rico Nuclear Center, 1963 to present.

LUSE, ROBERT A.
Head, Agricultural Bio-Sciences Division
Associate Scientist II

FIELD: Biochemistry, Biophysics

EDUCATION: B.A. Kalamazoo College, 1953; Ph.D., University of California, (Berkeley), 1961.

EXPERIENCE: Research Assistant, University of California, 1955-61; Associate Scientist II, Agricultural Bio-Sciences Division, Puerto Rico Nuclear Center, 1961 to present; Associate Investigator, Resonance in Radiation Project, February, 1962 to present; Head, Agricultural Bio-Sciences Division, Puerto Rico Nuclear Center, November, 1964 to present.

MARCIAL, VICTOR
Head, Radiotherapy & Cancer Division
Chief Scientist II
Professor of Radiation Therapy

FIELD: Radiation Therapy of Cancer

EDUCATION: B.S., University of Puerto Rico, 1944; M.D., Harvard Medical School, 1949.

EXPERIENCE: Intern, Bayamón District Hospital, 1949-50; General Practice of Medicine, 1950-51; Resident Radiation Therapy, Penrose Cancer Hospital, 1951-53; Basic Radioisotopes Course, Oak Ridge Institute of Nuclear Studies, 1953; Fellowship for the study of Radiation Therapy in Europe of the American Cancer Society, 1953-54; Residency in Tumor Pathology (6 months) at Barnes Hospital in Saint Louis; Residency in Radiotherapy at the Tumor Institute in Seattle, ending June 1955; Diplomate American Board of Radiology (Radiotherapy), May, 1955; Director, Bureau of Cancer Control, Puerto Rico Department of Health, 1955 to present; Professor of Radiation Therapy, University of Puerto Rico Medical School, 1958 to present; Director, Radiotherapy Department of Dr. I. González Martínez Oncologic Hospital; Head, Radiotherapy and Cancer Division, Puerto Rico Nuclear Center, 1958 to present.

ODUM, HOWARD T.
Director, Terrestrial Ecology Program I: The Rain Forest Project
Chief Scientist I

FIELD: Ecology, Oceanography

EDUCATION: Cadet Meteorology, Technical Training Command, USAAF, 1943-44; Institute of Tropical Meteorology, Puerto Rico, 1944; A.B., University of North Carolina, 1947; Marine Biological Laboratory, Woods Hole, Mass., 1947; Ph.D., (Zoology), Yale University, 1951.

EXPERIENCE: Teaching Assistant, University of North Carolina, 1942; Instructor, Tropical Weather School, Canal Zone, 1945; Teaching Assistant, Yale University, 1947-48; Assistant Professor, University of Florida, 1950-54; Eniwetok Research, 1954; Instructor, Woods Hole, Mass., 1953 and 1958; Assistant Professor, Duke University, 1954-56; Director, Graduate Advisor, Lecturer in Zoology, and Editor, Institute of Marine Science, The University of Texas, Port Aransas and Austin, 1956-63; Ad Honorem Professor, Department of Biology, University of Puerto Rico, 1963 to present; Director, Terrestrial Ecology Program I: The Rain Forest Project, Puerto Rico Nuclear Center, 1963 to present.

ROIG VALDIVIESO, EDWIN
Head, Radioisotopes Division
Chief Scientist II
Professor of Chemistry

FIELD: Chemistry

EDUCATION: B.S., Chemistry, University of Puerto Rico, 1944; M.S., Ph.D. in Chemistry, University of Pennsylvania, 1949, 1951; Radioisotope Techniques Course, Oak Ridge Institute of Nuclear Studies, June 1957.

EXPERIENCE: Assistant Instructor in Chemistry, University of Puerto Rico, 1945-46; Instructor in Chemistry, University of Puerto Rico, 1946-51; Assistant Professor in Chemistry, University of Puerto Rico, 1951-53; Senior Chemist, West Indies Mining Corporation, 1952-53; Associate Professor in Chemistry, University of Puerto Rico, 1953-57; Professor in Chemistry and Physics, College of the Sacred Heart, 1954-57; Associate Scientist, Radioisotope Applications Division, 1957-60; Head, Chemistry Department, University of Puerto Rico and Head, Radioisotope Applications Division, Puerto Rico Nuclear Center, 1960-62; Chief Scientist and Head, Radioisotope Applications Division, Puerto Rico Nuclear Center, 1962 to present.

SZMANT, H. HARRY
Organic Chemistry Project
Radioisotopes Division
Chief Scientist II
Professor of Chemistry

FIELD: Organic Chemistry

EDUCATION: B.A., Ohio State University, 1940; Ph.D., Purdue University, 1944.

EXPERIENCE: Research Chemist, Monsanto Chemical Company, 1944-46; Associate Professor and Professor, Duquesne University, 1946-56; Director, Center of Chemical Research, University of Oriente, Santiago de Cuba, 1956-61; Professor of Chemistry, University of Puerto Rico, and Chief Scientist, Radioisotope Applications Division, Puerto Rico Nuclear Center, 1961 to present.

WALKER, DAVID W.
Sugar Cane Borer Program
Agricultural Bio-Sciences Division
Associate Scientist II
Associate Professor of Biology

FIELD: Entomology

EDUCATION: B.S., Public Health and Preventive Medicine, University of Washington, Seattle, 1950; M.S., (Entomology), Washington State University, 1951; Ph.D., (Entomology), Washington State University, 1959.

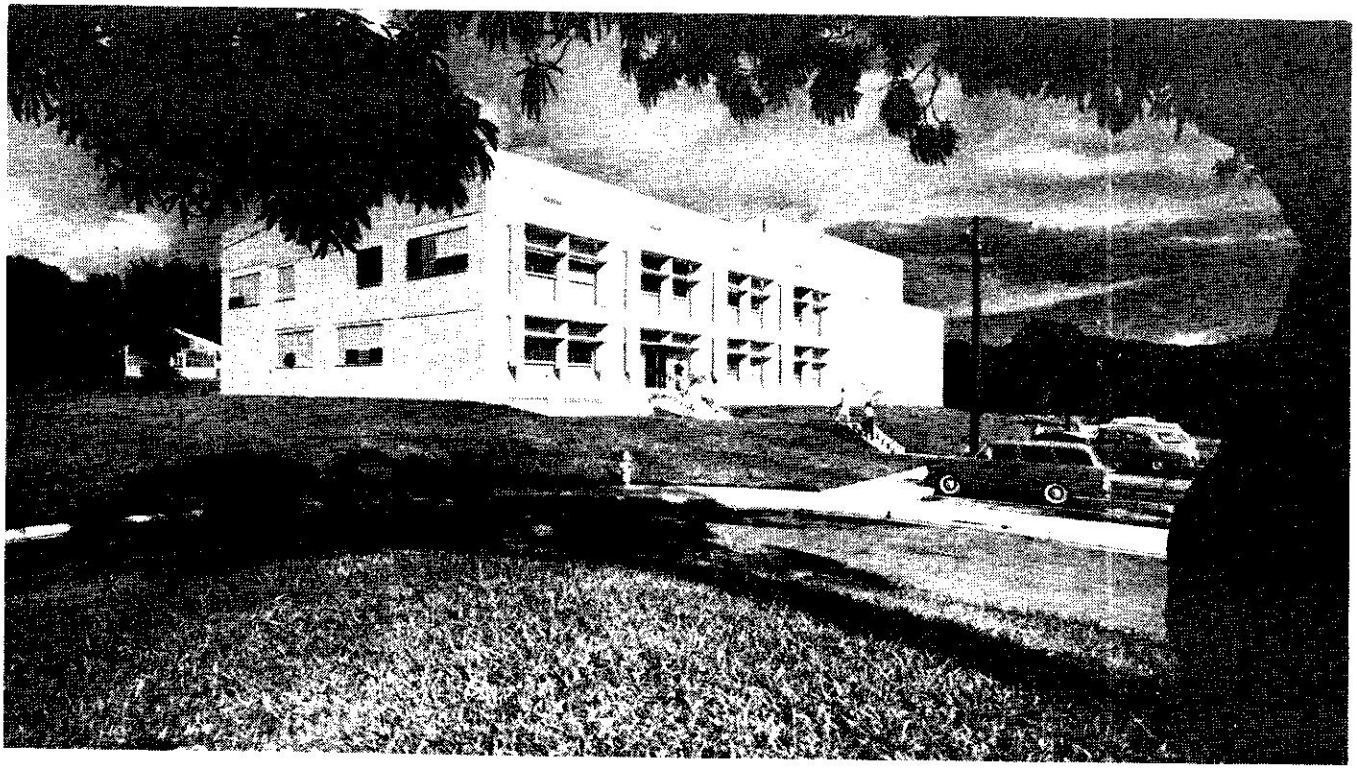
EXPERIENCE: Chief Sanitarian and Malaria Control Officer, United Nations Relief for Palestinian Refugees Commission, Gaza, Egypt, 1949-50; Teaching Assistant in Zoology, Washington State University, 1950-51; Entomologist and Consultant on Malaria Control to the Department of Health, Republic of the Philippines, U.S. Public Health Service, 1952-53; Junior Entomologist and Assistant Entomologist, Washington State University, 1953-59; Associate Professor, Biology Department, University of Puerto Rico, 1959 to present; Consultant, grain elevator companies, U.S. Commodity Stabilization Service, Commonwealth Experiment Station and Lajas Land Project, 1954 to present; Associate Scientist II, Agricultural Bio-Sciences Division, Puerto Rico Nuclear Center, 1963 to present.

WEINBREN, MAURICE PAUL
Head, Medical Sciences & Radiobiology Division
Chief Scientist II

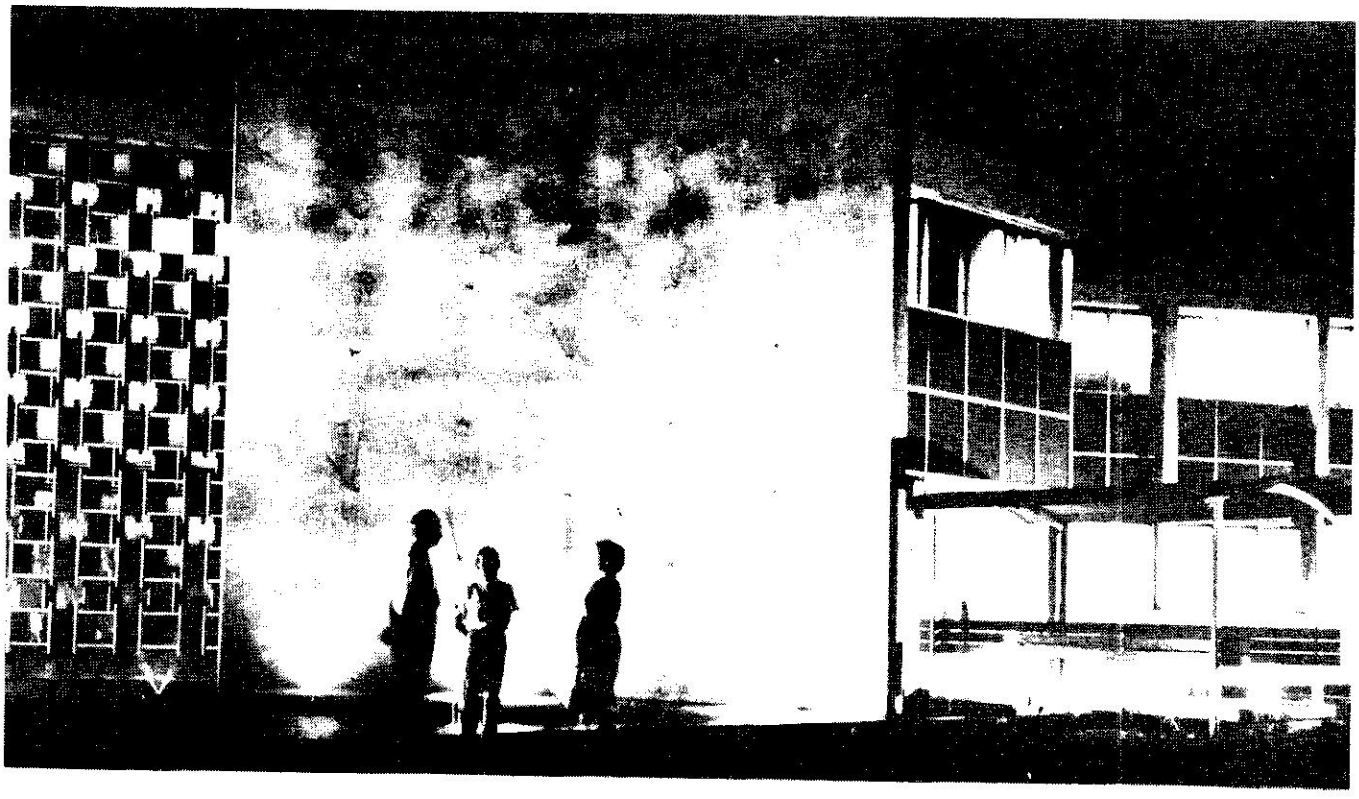
FIELD: Microbiology

EDUCATION: B.Sc., (Histology & Physiological Chemistry), 1946; B.Sc., Hons (Histology), University of Witwatersrand, Johannesburg, South Africa, 1947; M.R.C.S. (England) L.R.C.P. (London), Middlesex Hospital Medical School, London, England, 1951; M.D., (Pathology), University of Witwatersrand, Johannesburg, South Africa, 1961.

EXPERIENCE: House Surgeon, 1951-52; House Physician, 1952-53; Senior House Officer (Pathology), 6 months, 1953, all with British National Health Service; Medical Research Officer at Poliomyelitis Research Foundation, Johannesburg, South Africa, 1954-55, during which time attached to the Rockefeller Foundation Arthropod-borne virus Research unit: Virologist at the East African Virus Research Institute, Entebbe Uganda, 1955-59; Rockefeller Foundation fellowship to study activities in Arthropod-borne virus laboratories at Belem, Brazil; Port of Spain, Trinidad; Bogota and Villavicencio, Colombia; Berkeley, California; Hamilton, Montana; New Haven, Connecticut, and the Rockefeller Foundation Laboratory in New York, 1957-58; Senior Medical Officer in charge of the Arthropod-borne Virus Research unit at the Poliomyelitis Research Foundation, Johannesburg, South Africa, 1949-51; Head, Communicable Disease Unit, Division of Epidemiology, Public Health Research Institute of the City of New York, 1961-62; Head, Medical Sciences and Radiobiology Division, Puerto Rico Nuclear Center, 1962 to present.

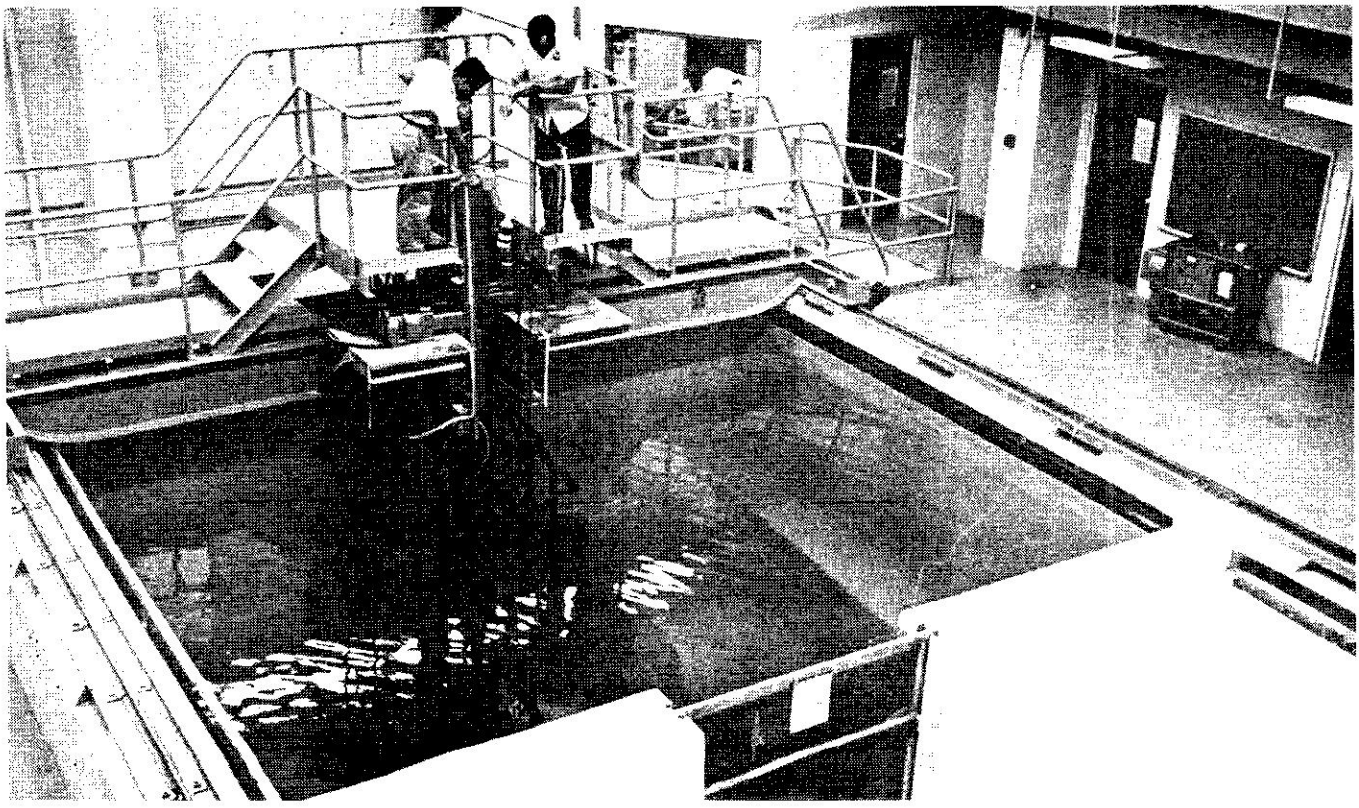


PRNC Laboratory - Reactor Building located in Mayaguez adjacent to the campus of the University of Puerto Rico College of Agriculture and Mechanic Arts

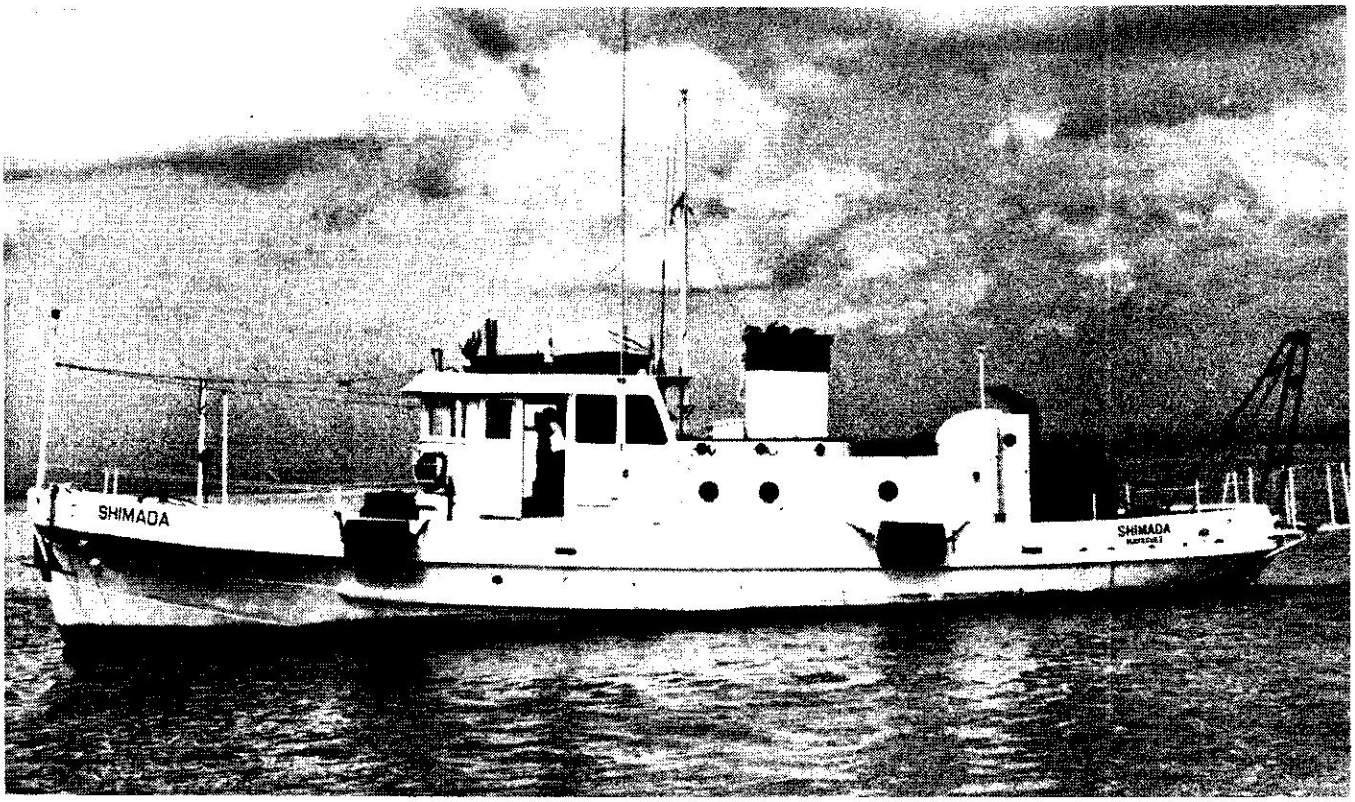


PRNC Bio-Medical Building located in Río Piedras within the new Puerto Rico Medical Center.

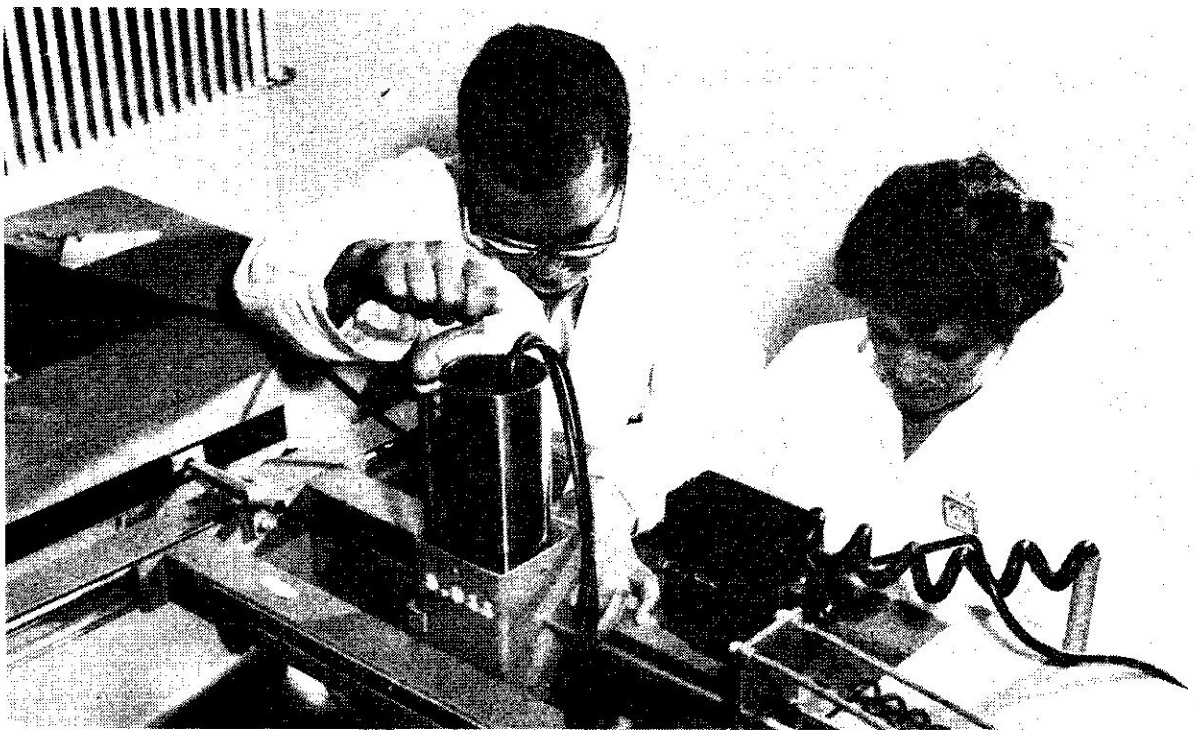
Control room for the PRNC pool type research reactor currently operating at a power level of one megawatt.



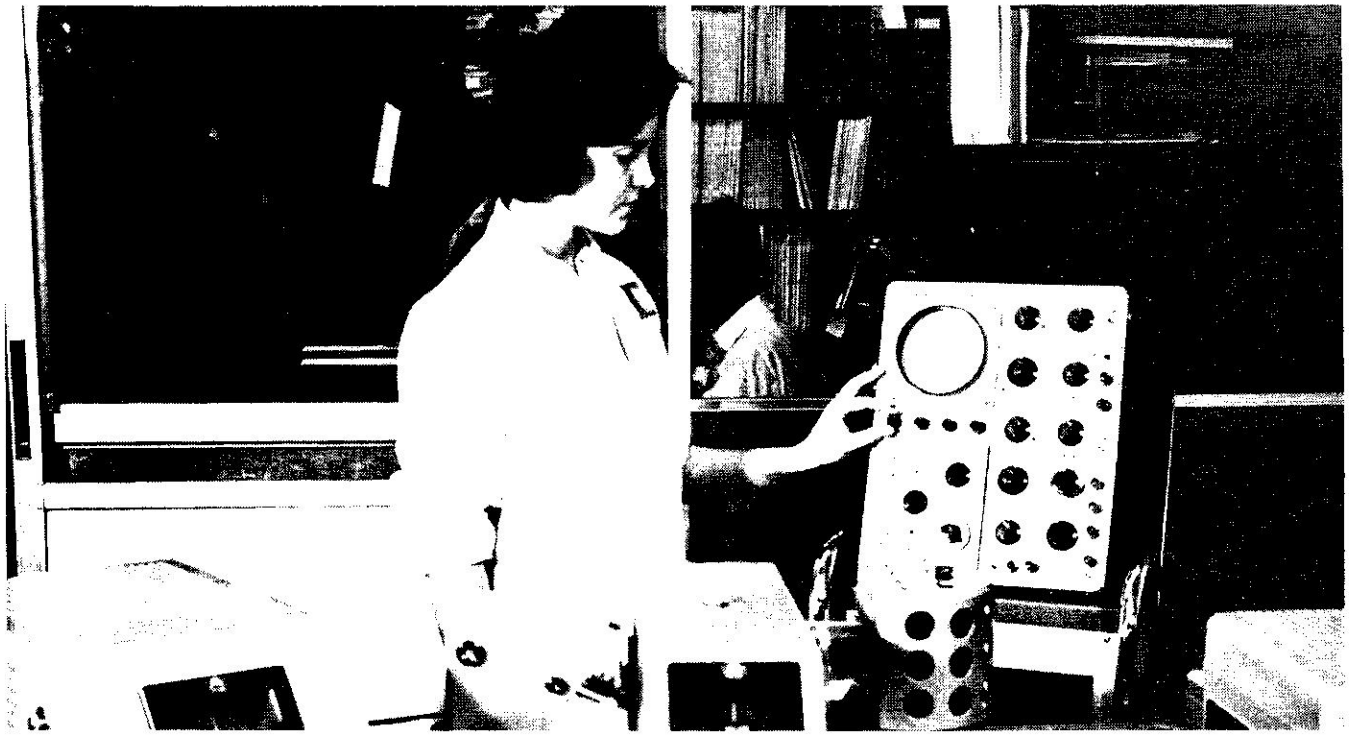
View of research reactor pool with control room visible in the rear.



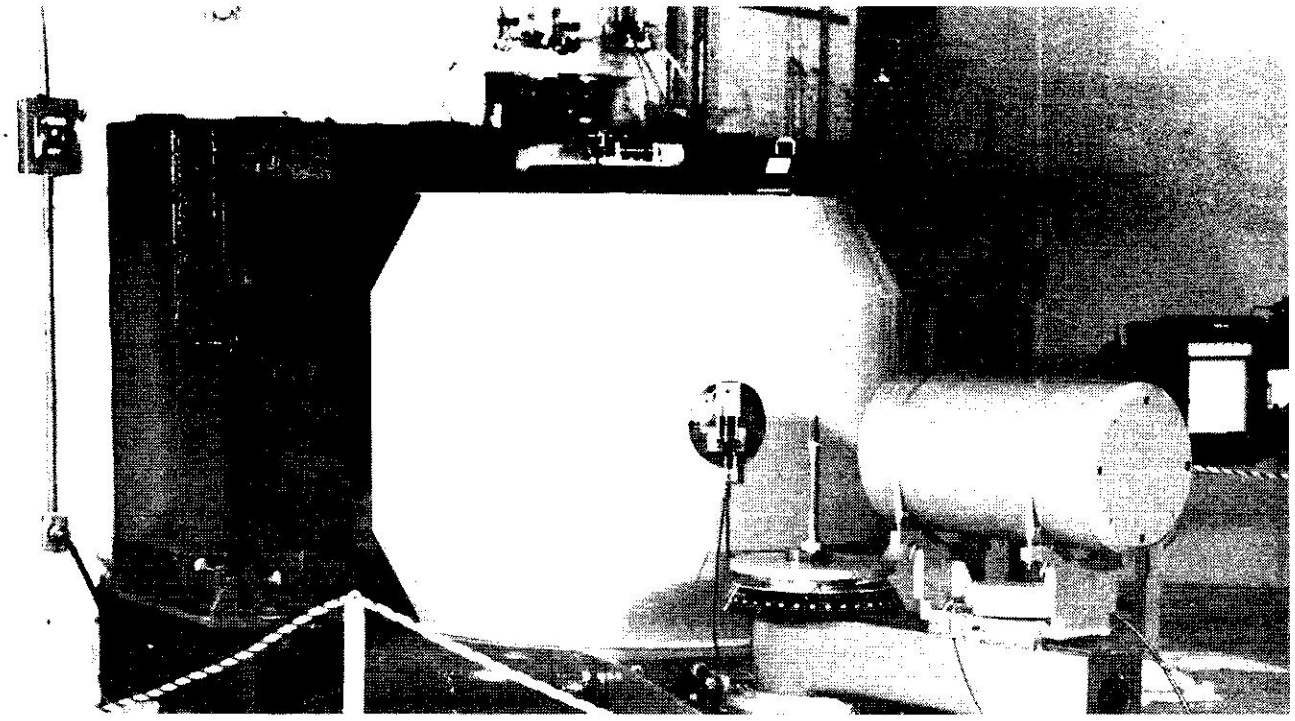
One hundred ton oceanographic research vessel Shimada equipped with "A" frame and laboratories for use in the Marine Biology Program.



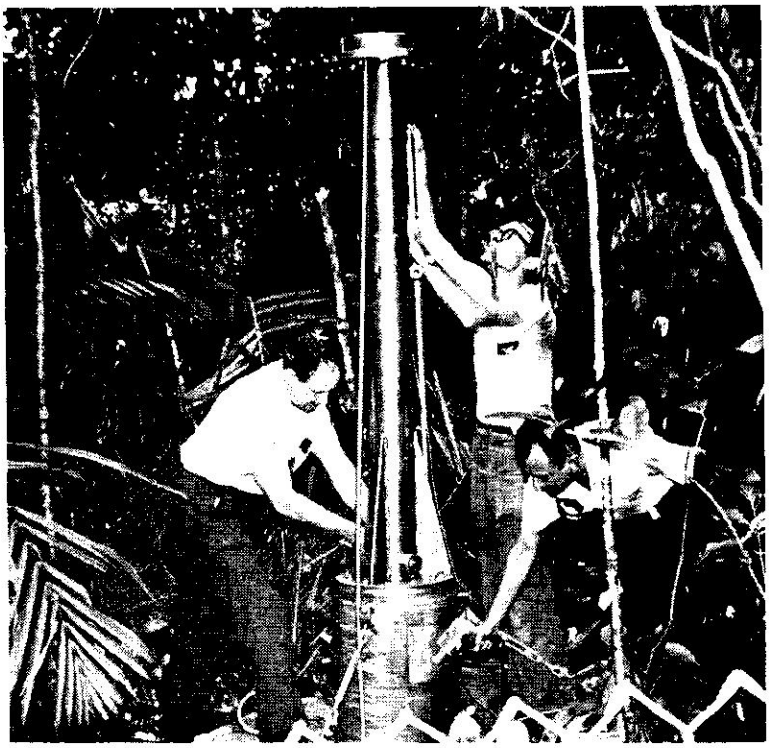
View of dot-scanning equipment used for organ visualization in the Clinical Applications Division. A second unit of this type was modified at PRNC for photoscanning, dot-scanning, and making an X-ray picture to provide exact organ localization.



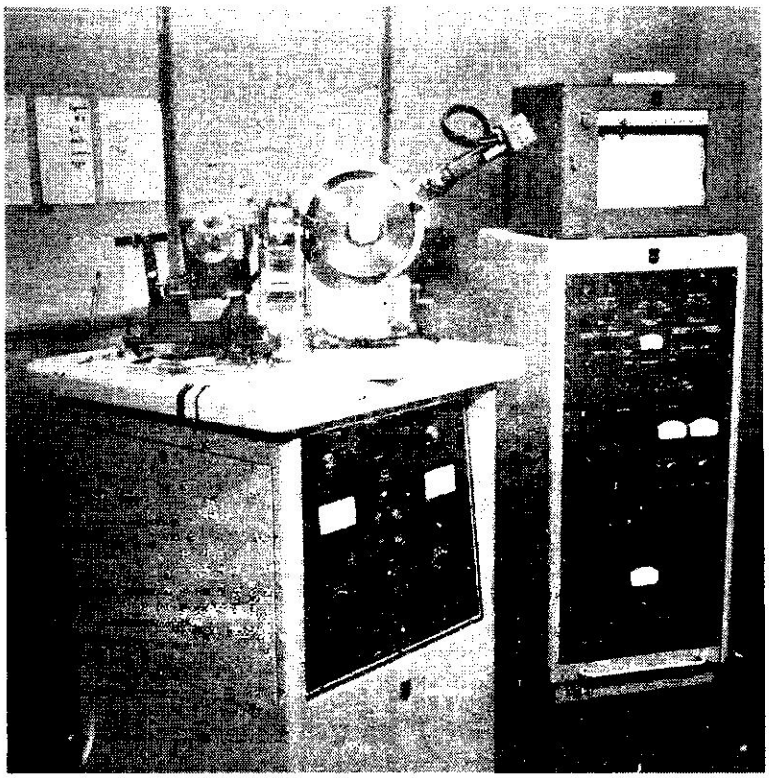
A graduate student is shown with an oscilloscope which is part of a flash photolysis system used in the Radiation Chemistry and Photochemistry Program. In the foreground is a Zeiss spectrophotometer which operates down to 1850 angstroms.



View of neutron spectrometer fabricated at Brookhaven National Laboratory for the PRNC Neutron Diffraction Program. It is designed to work with heavy magnets and cryostats and permits continuous variation of the neutron wavelength.



Apparatus containing the [illegible] Cesium 137 radiation source installed in the El Verde Forest for the PRNC Rain Forest Program. In the photo the men are connecting the controls which permit remote control of the source.



An X-ray spectrometer used in the Neutron Diffraction Program for crystallographic measurements.

U.S. ATOMIC ENERGY COMMISSION

BIO-MEDICAL PROGRAM DIRECTORS MEETING

February 8-9, 1965

PARTICIPANTS

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Oak Ridge Institute of Nuclear Studies
Oak Ridge, Tennessee

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U.S. Atomic Energy Commission
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Brookhaven National Laboratory
Upton L.I., N. Y.

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ZELLE, Max R.
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Argonne, Illinois

INVITED GUESTS

CORDERO, Juan César
Office of Civil Defense
San Juan, Puerto Rico

IRIARTE, Modesto
Puerto Rico Water Resources Authority
San Juan, Puerto Rico

LIST OF PRNC PERSONNEL

OFFICE OF THE DIRECTOR

J. C. Bugher....Director
H. J. Gomberg...Deputy Director
A. Cobas.....Associate Director
F. Rushford.....Tech. Asst. to Dir.
S. H. Walsh.....Tech. Asst. to Dir.
M. Barton.....Exec. Asst. to Dir.
A. E. Kay.....Research Assistant
D. Reed.....Research Assistant
B. M. Rosado....Administrative Asst.
I. Rivera.....Administrative Asst.
S. F. Casellas..Administrative Asst.
S. Correa.....Administrative Asst.
O. R. Díaz.....Administrative Asst.
E. Hernández....Technical Assistant
L. Rodríguez....Technical Assistant
M. P. Zurinaga..Technical Assistant
R. Rivera.....Technical Assistant
S. Santiago.....Technical Assistant

ADMINISTRATION & SERVICE

L. E. Boothby...Sr. Admin. Officer
J. A. Colón.....Admin. Officer
R. Muñiz.....Admin. Officer
P. Vélez.....Admin. Officer
M. Segarra.....Research Assistant
N. Hernández....Administrative Asst.
N. B. Gómez.....Administrative Asst.
A. N. Alfaro....Administrative Asst.
H. Camacho.....Administrative Asst.
J. J. Ojeda.....Administrative Asst.
I. Acosta.....Technical Assistant
C. F. Barceló...Technical Assistant
M. T. Báez.....Technical Assistant
G. Torres.....Technical Assistant
M. Mengel.....Technical Assistant
E. de la Rosa...Technical Assistant
C. R. Brown.....Technical Assistant
W. Nieves.....Technical Assistant
A. Quintana.....Technical Assistant
I. Báez.....Technical Assistant
W. Soto.....Technical Assistant
I. L. Pagán.....Technical Assistant
I. Martínez.....Technical Assistant
E. L. Cardona...Technical Assistant
C. Hernández....Technical Assistant
A. J. Morell....Technical Assistant
M. A. Soto.....Technical Assistant
J. López.....Technical Assistant
O. Rivera.....Technical Assistant
N. López.....Technical Assistant
H. Montañez.....Technical Assistant
J. de Jesús.....Technical Assistant
J. Valentín.....Technical Assistant
D. Torres.....Technical Assistant
R. L. Barreto...Telephone Operator
R. Moreno.....Telephone Operator
A. Pereira.....Student Assistant

TECHNICAL SERVICES (RIO PIEDRAS)

W. A. Moore.....Research Associate
L. Canales.....Building Engineer
A. Bravo.....Technical Assistant
W. González.....Technical Assistant
D. Fernández....Technical Assistant
A. Rivera.....Technical Assistant
V. Montañez.....Technical Assistant
J. D. Zayas.....Technical Assistant
M. A. Martínez..Technical Assistant
M. Nazario.....Technical Assistant

TECHNICAL SERVICES (MAYAGUEZ)

M. Beauchamp....Research Associate
H. Besselievre..Research Associate
J. R. Boria.....Research Assistant
H. Tirado.....Research Assistant
V. Lequérique...Research Assistant
F. Cámara.....Research Assistant
E. Ramírez.....Research Technician
H. Ayguabibas...Research Technician
M. Rivera.....Research Technician
A. González.....Technical Assistant
J. M. Dietsh....Technical Assistant

A. Gaztambide...Technical Assistant
J. A. Bonilla...Technical Assistant
R. Medina.....Carpenter
M. Soto.....Janitor
A. Osorio.....Janitor
E. Agostini.....Maintenance Worker
R. Aponte.....Mechanic
E. Seda.....Lab. Equip. Mechanic
J. Morales.....Laborer
P. Valentín.....Laborer
R. Ramos.....Laborer

NUCLEAR SCIENCE & TECHNOLOGY

O. H. Wheeler...Chief Scientist
E. Ortiz.....Chief Scientist
J. Facetti.....Associate Scientist
B. Cruz.....Research Associate
J. Gonzalo.....Research Associate
J. E. Trabal....Research Assistant
R. Montalvo.....Research Assistant
E. Rodríguez....Research Assistant
J. M. Rivera....Research Assistant

M. Santiago.....Research Assistant
O. Matos.....Research Assistant
S. Torres.....Research Technician
G. Gaztambide...Research Technician
P. P. Ossorio...Research Technician
I. R. Varela....Technical Assistant
N. L. Arcelay...Technical Assistant
S. Ruiz.....Technical Assistant

REACTOR DIVISION

H. Barceló.....Chief Scientist
R. Brown.....Associate Scientist
J. J. Soltero...Research Associate
M. Rodríguez....Research Assistant
N. Quiñones.....Research Assistant
H. Ojeda.....Research Assistant

J. Alemañy.....Research Assistant
D. Irizarry.....Technical Assistant
V. Gaztambide...Mechanic
L. Acevedo.....Laborer
J. Cuebas.....Janitor

RADIOISOTOPE APPLICATION

E. Roig.....Chief Scientist
H. H. Szmant....Chief Scientist
J. Castrillón...Associate Scientist
R. S. Tirado....Research Associate
J. J. Rigau.....Research Assistant

A. Carrasquillo.Research Assistant
R. Figueroa.....Research Assistant
A. R. Torres....Administrative Asst.
S. Rodríguez....Technical Assistant

HEALTH PHYSICS DIVISION

J. A. Ferrer....Chief Scientist
Paraskevoudakis.Associate Scientist
P. Cruz.....Research Associate
H. Pabón.....Research Associate
F. Vallecillo...Research Assistant
M. Gileadi.....Research Assistant
M. H. Vega.....Research Assistant
M. L. Cruz.....Research Assistant
N. T. Cardona...Research Technician
I. González.....Technical Assistant
L. Vargas.....Technical Assistant
I. F. Rivera....Technical Assistant
J. L. Ortiz.....Student Assistant

RADIOTHERAPY & CANCER DIVISION

V. A. Marcial...Chief Scientist
J. M. Tomé.....Chief Scientist
J. N. Correa....Associate Scientist
J. Ubiñas.....Associate Scientist
A. Bosch.....Associate Scientist
G. M. Serna.....Associate Scientist
M. P. Lozano....Research Associate
Z. Frías.....Research Associate
A. Valencia.....Research Assistant
L. Padilla.....Research Technician
I. Velázquez....Research Technician
G. Marrero.....Research Technician
J. Hernández....Technical Assistant
Y. Astacio.....Technical Assistant
N. M. Ramos.....Technical Assistant
C. M. Cruz.....Clerk Typist

CLINICAL RADIOISOTOPES DIVISION

S. Irizarry.....Chief Scientist
A. Lanaro.....Associate Scientist
M. I. Rivera....Research Technician
C. Villodas.....Research Technician
P. Collazo.....Research Technician
N. Gándara.....Research Technician
H. R. Colón.....Research Technician
R. Rodríguez....Research Technician
L. G. Nieves....Research Technician
D. Escalera.....Technical Assistant
E. Gutiérrez....Technical Assistant
E. Rodríguez....Technical Assistant

AGRICULTURAL BIO-SCIENCES DIVISION

D. B. Linden....Associate Scientist
R. A. Luse.....Associate Scientist
F. K. S. Koo....Associate Scientist
A. Maretzki.....Associate Scientist
D. Walker.....Associate Scientist
F. Padovani.....Research Assistant
A. García.....Research Technician
C. L. Pereles...Research Technician
I. Pérez.....Research Technician
V. B. Medina....Technical Assistant
G. Hernández....Gardener
D. Valentín.....Laborer

MEDICAL SCIENCE & RADIOBIOLOGY DIVISION

M. P. Weinbren..Chief Scientist
J. B. Villella..Associate Scientist
B. M. Weinbren..Associate Scientist
S. J. de Jesús..Research Assistant
A. V. Seijo.....Research Assistant
W. Rosaly.....Research Technician

MEDICAL SCIENCE & RADIOBIOLOGY DIVISION (continued)

A. Santiago.....Research Technician
C. Carrasquillo.Research Technician
I. Vázquez.....Research Technician
J. Oliver.....Research Technician
L. Valentín.....Research Technician
R. Aponte.....Technical Assistant
D. López.....Technical Assistant
A. de Jesús.....Technical Assistant
M. Laborde.....Technical Assistant

NUCLEAR ENGINEERING DIVISION

J. G. de Quevedo Chief Scientist
D. Sasscer.....Chief Scientist
P. Osborne.....Chief Scientist
K. Soderstrom...Research Associate
C. Wheeler.....Research Associate
L. Vázquez.....Research Assistant
M. Cotto.....Research Assistant
E. Ramírez.....Administrative Asst.

INTERNATIONAL NE EXHIBIT PROGRAM

F. Muñoz.....Research Associate
J. Díaz.....Research Assistant
N. Arcelay.....Technical Assistant

MARINE BIOLOGY PROGRAM

F. G. Lowman....Chief Scientist
D. K. Phelps....Associate Scientist
R. Stevenson....Associate Scientist
E. Avila.....Research Associate
R. McClin.....Research Associate
R. Santiago.....Research Assistant
E. Ramos.....Research Assistant
I. Padovani.....Research Assistant
V. R. Vega.....Research Assistant
L. Quiñones.....Research Assistant
S. H. Lugo.....Research Assistant
D. S. Erdman....Research Assistant
R. J. García....Research Assistant
R. W. Davis.....Research Assistant
S. López.....Boat Capt. & Machinist
N. del Toro.....Technical Assistant
E. Jusino.....Technical Assistant
E. Zapata.....Technical Assistant
M. S. Cruz.....Technical Assistant
J. Almenia.....Watchman
C. E. Folch.....Student Assistant

TERRESTRIAL ECOLOGY PROGRAM - PART I

H. T. Odum.....Chief Scientist
F. K. S. Koo....Associate Scientist
G. Drewry.....Associate Scientist
P. Murphy.....Research Assistant
E. Irizarry.....Research Assistant
S. Smith.....Research Assistant
E. Matos.....Research Assistant
A. Lugo.....Research Assistant
C. Venator.....Research Assistant
A. J. Correa....Administrative Asst.
M. de Arce.....Research Technician
A. Estrada.....Technical Assistant
J. Martínez.....Technical Assistant
D. Martínez.....Technical Assistant
E. Rivera.....Technical Assistant
J. Ruiz.....Technical Assistant

TERRESTRIAL ECOLOGY PROGRAM - PART I (continued)

M. Parrilla.....Technical Assistant
J. Meléndez.....Technical Assistant
J. Rosario.....Technical Assistant
A. Rossy.....Student Assistant
E. Díaz.....Student Assistant

RESONANCE IN RADIATION EFFECTS PROGRAM

R. A. Luse.....Associate Scientist
F. Vázquez.....Research Associate
C. L. Pereles...Research Technician
L. Ramírez.....Laboratory Assistant
M. Cancel.....Student Assistant

RADIATION CHEMISTRY & PHOTOCHEMISTRY PROGRAM

M. Daniels.....Associate Scientist
E. Belardo.....Research Assistant
H. Cancel.....Research Technician

PARAMUTATION PROGRAM

D. B. Linden....Associate Scientist
J. Cuevas.....Research Assistant
F. Montalvo.....Laborer
S. Valentín.....Laborer

TERRESTRIAL ECOLOGY PROGRAM - PART II

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D. M. Jiménez...Research Technician
E. Colón.....Research Technician
M. Montañez.....Technical Assistant
N. de Jesús.....Technical Assistant
W. L. Rejincos..Technical Assistant
L. G. Colón.....Technical Assistant
A. Maldonado....Technical Assistant
A. Colón.....Technical Assistant
M. Ramos.....Technical Assistant

SCHISTOSOMA MANSONI PROGRAM

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F. Liard.....Research Assistant
H. Segarra.....Research Technician
J. L. Gómez.....Technical Assistant
J. Rivera.....Technical Assistant

SUGAR CANE BORER PROGRAM

D. Walker.....Associate Scientist
A. V. Alemañy...Research Assistant
V. Quintana.....Research Assistant

NEUTRON DIFFRACTION PROGRAM

M. I. Kay.....Chief Scientist
I. Almodóvar....Associate Scientist
H. J. Bielen....Associate Scientist
K. Okada.....Associate Scientist

J. R. Cruz.....Research Assistant
M. Vázquez.....Technical Assistant
N. Vélez.....Technical Assistant
E. Cintrón.....Laboratory Assistant

SOLID STATE PHYSICS PROGRAM

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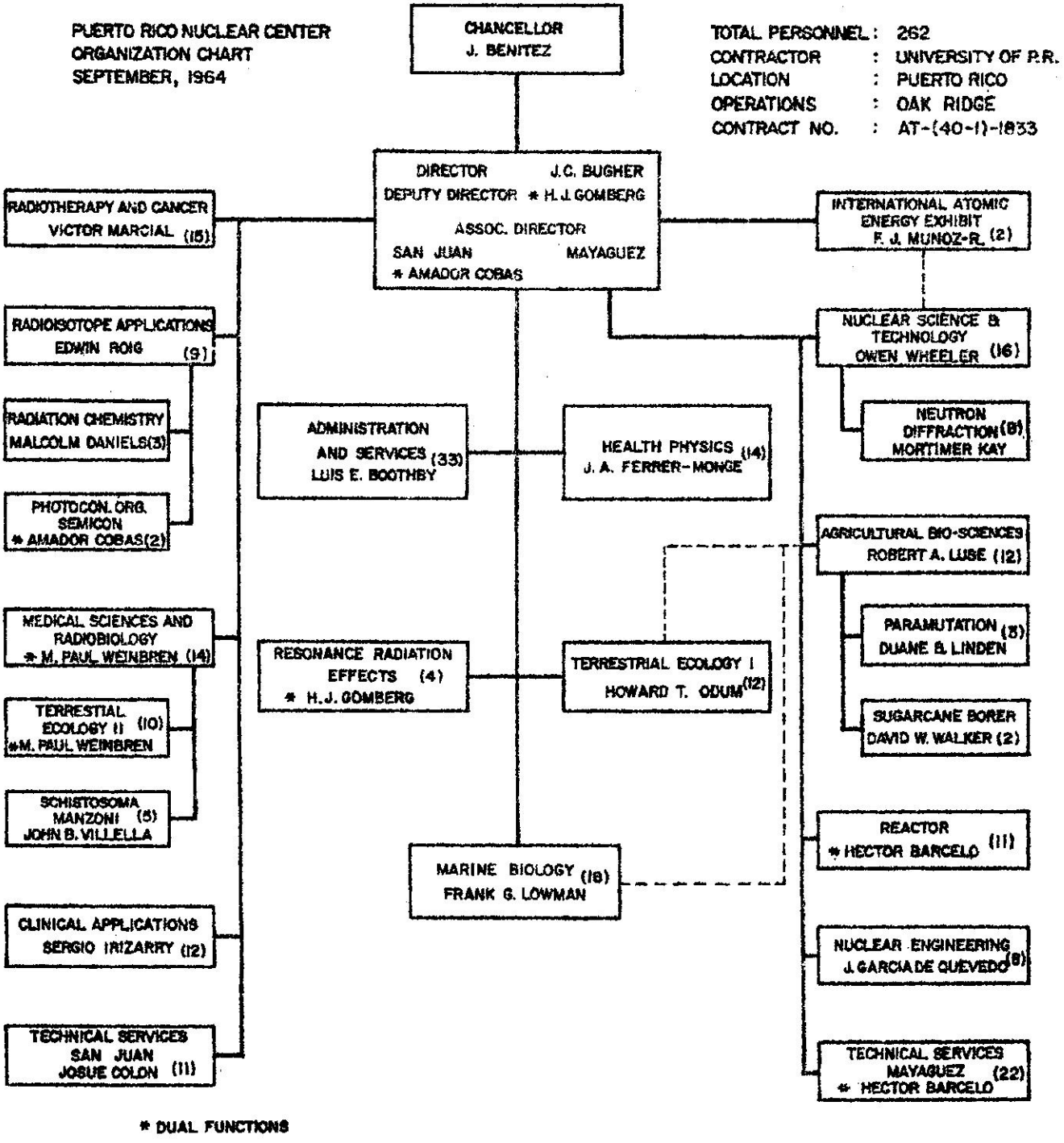
J. Chalverus....Student Assistant


PUERTO RICO NUCLEAR CENTER
ORGANIZATION CHART
SEPTEMBER, 1964
CHANCELLOR
J. BENITEZ
TOTAL PERSONNEL : 262
CONTRACTOR : UNIVERSITY OF P.R.
LOCATION : PUERTO RICO
OPERATIONS : OAK RIDGE
CONTRACT NO. : AT-(40-1)-1833
DIRECTOR J.C. BUGHER
DEPUTY DIRECTOR * H.J. GOMBERG
ASSOC. DIRECTOR
SAN JUAN MAYAGUEZ
* AMADOR COBAS
RADIOTHERAPY AND CANCER
VICTOR MARCIAL (15)
RADIOISOTOPE APPLICATIONS
EDWIN ROIG (9)
RADIATION CHEMISTRY
MALCOLM DANIELS(3)
PHOTOCON. ORG. SEMICON
* AMADOR COBAS(2)
MEDICAL SCIENCES AND RADIOBIOLOGY
* M. PAUL WEINBREN (14)
TERRESTIAL ECOLOGY II (10)
*M. PAUL WEINBREN
SCHISTOSOMA MANZONI (5)
JOHN B. VILLELLA
CLINICAL APPLICATIONS
SERGIO IRIZARRY (12)
TECHNICAL SERVICES
SAN JUAN
JOSUE COLON (11)
ADMINISTRATION AND SERVICES (33)
LUIS E. BOOTHBY
RESONANCE RADIATION EFFECTS (4)
* H.J. GOMBERG
MARINE BIOLOGY (18)
FRANK G. LOWMAN
HEALTH PHYSICS (14)
J. A. FERRER-MONGE
TERRESTRIAL ECOLOGY I
HOWARD T. ODUM (12)
INTERNATIONAL ATOMIC ENERGY EXHIBIT
F. J. MUNOZ-R. (2)
NUCLEAR SCIENCE & TECHNOLOGY
OWEN WHEELER (16)
NEUTRON DIFFRACTION (8)
MORTIMER KAY
AGRICULTURAL BIO-SCIENCES
ROBERT A. LUSE (12)
PARAMUTATION (5)
DUANE B. LINDEN
SUGARCANE BORER
DAVID W. WALKER (2)
REACTOR
* HECTOR BARCELO (11)
NUCLEAR ENGINEERING
J. GARCIA DE QUEVEDO (8)
TECHNICAL SERVICES
MAYAGUEZ (22)
* HECTOR BARCELO
* DUAL FUNCTIONS

NOTES FOR JCB:

1. Program changes--The presentation scheduled for 11:30 a.m. will be given after lunch. Buses will leave for Cecilia's Restaurant at 11:30 a.m. Cocktails will be served when we arrive, and to expedite table service, we shall pass out a mimeographed list of the luncheon choices during coffee break, and ask participants to indicate what they would like. Return mimeographed form to Miss Correa at Information Desk.

2. May indicate that Sylvia will be glad to reconfirm travel reservations, etc. For group who plan to depart on Tuesday afternoon, they should indicate to her if they plan to go to the airport directly from the Center so that we may plan special transporation for them.

3. Field trips--Olga Diaz will be at the Field Trip desk, and will arrange for those interested in going to Mayaguez on Wednesday.

4. You may wish to announce the amount of money that is to be collected--

   $10 -- for a man alone

   $15 -- if wife taken to Caribe Monday night

4. Tour of Building--In order to have groups leave in an orderly fashion, I think we should cancel the last coffee break scheduled for 3:45 p.m. on Monday. The four guides should be introduced in the same order as they leave the building, one at a time with her group:

   Miss Marta de Arce --White tags

   Mrs. Sara Jean de Jesús -- Green tags

   Miss Zenaida Frías -- Pink tags

   Miss Irma Vazquez -- Yellow tags

J.J. - FRNC

Pay after lunch on leaving main building

Puerto Rico Nuclear Center
Operated by
University of Puerto Rico
for
U.S. Atomic Energy Commission

February 2, 1965

Memorandum

To : Río Piedras Division Heads

From : Marie Barton

Subject: Tour of Bio-Medical Building 2/8/65

As agreed on Monday's meeting, February 1, participants in the Bio-Medical Program Directors meeting will be taken on a tour of the Bio-Medical building similar to the one arranged for the American Public Health Association about a year ago. The tour will be Monday, February 8, from 4:00 to 5:00 p.m., and all staff will be expected to remain in offices and laboratories until the tour ends and the buses leave for the Da Vinci Hotel.

The guests will be given identification tags of four different colors when they register Monday morning. At 3:00 p.m., four guides, identified by color badge and ribbon, will join the audience in the meeting room. Before closing Monday's meeting, Dr. Bugher will explain how the tour will be conducted and introduce the guests to their respective guides.

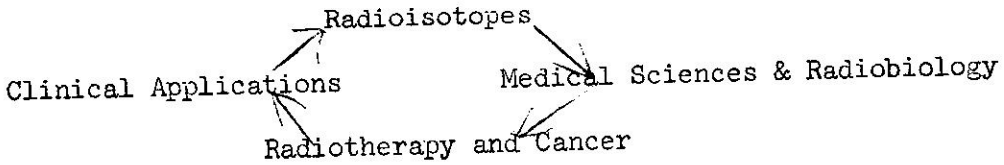
At 3:50 p.m. the guides will take their groups to the following starting points in the Bio-Medical building:

Sara Jean de Jesús (green tag) - Corridor leading to back exit to Chemistry Laboratory, 2nd floor. (Radioisotopes Division - Dr. Edwin Roig)

Irma Vázquez (yellow tag) - First floor lobby. (Medical Sciences and Radiobiology - Dr. Paul Weinbren)

Zenaida Frías	(pink tag) - Corridor leading to Cancer Hospital (Radiotherapy and Cancer - Dr. Víctor Marcial)
Marta de Arce	(white tag) - End of corridor on second floor near door to temporary animal facilities (Clinical Applications - Dr. Sergio Irizarry)

As soon as groups arrive, Division Heads will outline their programs (13 minutes allowed). At the sound of the telephone chimes, the presentation must end. The guide will lead her group to the next Division Head, as shown on the diagram below:



Each Division Head will repeat his presentation four times. At the end of the fourth presentation, guides will return their groups to the lobby.

Buses to return guests to the Da Vinci Hotel will be parked in front of the Bio-Medical Building.

The timing of presentations and group movements are as follows:

4:00	- 4:13 P.M.	-	1st. presentation
4:13	- 4:15 P.M.	-	Groups move
4:15	- 4:28 P.M.	-	2nd. presentation
4:28	- 4:30 P.M.	-	Groups move
4:30	- 4:43 P.M.	-	3rd. presentation
4:43	- 4:45 P.M.	-	Groups move
4:45	- 5:00 P.M.	-	4th presentation.

U. S. ATOMIC ENERGY COMMISSION
BIO-MEDICAL PROGRAM DIRECTORS MEETING
February 8-9, 1965

PARTICIPANTS

AT THE DA VINCI HOTEL	ROOM NUMBER
BARR, Nathaniel F. (and Mrs)	531
BLAIR, Henry A. (and Mrs)	341
BOND, Victor P. (and Mrs)	433
BORN, J. L. (and Mrs)	232
BRUNER, H. D.	741
BURR, W. W.	637
CLAUS, Walter D.	333
COWMAN, Frederick P. (and Mrs)	635
CURTIS, Howard J.	337
DAVIS, Jared J. (and Mrs)	839
DEAL, L. Joe	637
DONALDSON, Laure R. (and Mrs)	338
DUDA, George D.	333
DUNHAM, Charles L. (and Mrs)	332
ELMO, Rosemary	331
ENGLUND, Kenneth L. (and Mrs)	536
GARDINER, Donald M. (and Mrs)	539
GOFMAN, John W.	640
GRAHN, Douglas	542
HALL, Nathan S. (and Mrs)	732
HARLEY, John H.	337
HARPER, Paul V.	432
HERDE, KARL E.	641
HOLLAENDER, Alexander (and Mrs)	231
HUDSON, Miller N. (and Mrs)	335
JACOBSON, Leon O.	432
KORNBERG, H. A. (and Mrs)	433
LONG, Anton	639
LANGHAM, Wright H. (and Mrs)	435
MARINELLI, Leonidas	237
MARKO, Anthony	636
MINKLER, Jason	640
MORGAN, Karl Z. (and Mrs)	638
NYGAARD, Oddvar	741
PLACE, Cameron	636
POOR, Russell	533
REINHARDT, William O. (and Mrs)	233
ROSS, Joseph	641
ROTH, Herman	533
ROTHSTEIN, Aser (and Mrs)	334
ROWLAND, Robert E. (and Mrs)	541
SHIPMAN, THOMAS L. (and Mrs)	441
SHOUP, Charles S. (and Mrs)	731
TOTTER, John R. (and Mrs)	436
WHITE, Clayton S.	339
WOLFE, John N. (and Mrs)	833
ZELLE, Max R.	542

AT THE T. LLAMAS HOTEL

Chiriboga, Jorge

AT THE OLYMPO COURT HOTEL

ANDREWS, Gould (and Mrs)

AT THE HOLIDAY INN HOTEL

LUSHBAUGH, C. C. (and Mrs)

Puerto Rico Nuclear Center
Operated by
University of Puerto Rico
for
U.S. Atomic Energy Commission

NOTE TO WIVES:

On Monday, February 8, several short trips have been planned. Please call Mrs. Barton at the Puerto Rico Nuclear Center (767-0350) on Sunday, February 7, to let her know the trips in which you are interested.

9:30 - 11:30 am. -- A tour of several local gardens has been planned by the Puerto Rico Garden Club. Transportation will be provided.

1:30 p.m. -- Two trips are planned for the afternoon, one to Luquillo Beach, and one to El Yunque. Below is a description of both places which may help you decide which one you wish to visit.

LUQUILLO BEACH

Luquillo is the name of a small, pleasant fishing village about 25 miles east of San Juan (40 minutes by car on route 3, a first-class highway). It is famous for its lovely beach, which is ranked among the most beautiful in the world.

The beach itself is a mile long with clean, white sand and sparkling clear water. It fronts the Atlantic Ocean and is protected by a jetty of land, Point Embarcadero, that juts into the sea.

Facilities at the beach include over 2,000 lockers housed in a modern concrete bath house. Showers and toilet facilities plus the use of a locker for the day costs 10 cents.

Picnic tables and benches are stretched along the length of the lawn that leads to the beach. Palm trees in rows of five or six are carefully planted along the lawn. Parking in the adjoining lot cost 25 cents for the day.

Luquillo Beach is maintained by the government and is open to the public from 8:00 am. to 6:00 pm. on Saturdays and Sundays, from 10:00 am. to 6:00 pm. on Tuesday through Fridays, and from 2:00 pm. to 6:00 pm. on Mondays.

Tour buses and públicos leave San Juan for Luquillo Beach at various times during the day.

EL YUNQUE

Puerto Rico offers one attraction that cannot be found in any other resort area in the Western World - its tropical rain forest at El Yunque.

Towering more than 3,500 feet into the clouds, El Yunque -- The Anvil -- is part of the Caribbean National Forest that was established by President Theodore Roosevelt in 1903 and declared an Experimental Forest in 1956. You can see El Yunque's imposing silhouette against the clear tropical sky from almost any point in San Juan.

Only about 25 miles to the southeast of San Juan, a drive of a little less than an hour will take you to the recreational area. From here you can hike to the peak on well-marked trails.

El Yunque's wild green beauty stems from the heavy rainfall in this area. Annual rainfall averages over 180 inches. Tropical tree species grow with amazing rapidity. More than 300 species have been identified, many peculiar to Puerto Rico and El Yunque alone. Tree ferns of more than 50 varieties range along the trail leading to the top -- some delicately small, looking like green lace, and others growing to heights of more than 300 feet. Tiny delicate orchids growing on trees, rocks, and logs produce large sprays of yellow flowers that resemble a swarm of butterflies. Other plants are brilliantly flame-colored.

La Mina Recreation Area is the jumping off sport for those wishing to climb to El Yunque peak. There are two streamfed swimming pools and an excellent restaurant serving Puerto Rican diches.

Every week-end the several trails of El Yunque are busy with small groups headed for eastern "top of the island". From the top, you can see both the Atlantic and the Caribbean as well as the small town below. The ascent to the Pinnacles, one of the trails, is climaxed by a dramatic climb up a steep flight of 100 steps to the sentry tower that dates back to early Spanish colonial days. The climb takes about 40 minutes, with rest shelters along the way.

Puerto Rico Nuclear Center
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U.S. ATOMIC ENERGY COMMISSION
BIO-MEDICAL PROGRAM DIRECTORS MEETING
February 6-9, 1965

The Da Vinci Hotel opened officially only a few days ago and restaurant facilities are still not available. However, you are near many hotels and restaurants where early breakfasts are served. For dinner, pages 45 to 50 of the QUE PASA guide, which is enclosed in the GENERAL INFORMATION kit, lists many restaurants in the Metropolitan Area which you may be interested in trying.

SUNDAY, February 7, 1965

Participants arriving before Sunday were mailed inquiries regarding their interest in a Sunday field trip. Transportation to the rainforest project will leave the Da Vinci Hotel at 1:00 pm. Arrangements to visit the Marine Biology Program may be made by calling the PRNC office (767-0350) on Sunday morning after 8:00 am. The trip to Mayaguez by car is three hours one-way and 25 minutes by Caribair Airline.

Participants staying after the meetings may arrange field trips for Wednesday, February 9. There will be a desk outside of the meeting room at the Center, where these trips can be scheduled.

MONDAY, February 8, 1965

On Monday morning two buses will be parked at the Da Vinci Hotel (on Vendig Street) at 7:15 am. It is important that these buses depart no later than 7:30 am. inorder to reach the Center by 8:30 am. when the program begins.

PLEASE BRING THIS FOLDER WITH YOU. THE IDENTIFICATION TAG AND THE FILM BADGE IN THE ENCLOSED ENVELOPE ARE TO BE WORN ON ALL FIELD TRIPS AND AT ALL MEETINGS IN WHICH YOU PARTICIPATE. AT THE END OF YOUR VISIT THE FILM BADGE MUST BE RETURNED TO THE PUERTO RICO NUCLEAR CENTER.

Lunch on Monday will be at Cecilia's Restaurant. Bus transportation will be provided. At 5:00 pm the group will return by bus to the Da Vinci.

You (and your wife if she is with you) are invited for cocktails and dinner at the San Gerónimo Room of the Caribe Hilton at 7:30 pm. with our staff. Cocktails are courtesy of the Center. Dinner is "Dutch". Buses will leave the Da Vinci at 7:15 pm. and will return at the end of the evening.

TUESDAY, February 9, 1965

Buses will be at the Da Vinci Hotel at 7:15 am. and will leave at 7:30 am.

Sandwiches and coffee will be served for lunch.

From your travel schedules we note that a group will be returning to Washington, D.C. on the 5:00 pm. plane. Some of you may wish to leave directly from the Center. Arrange for transportation to the airport with Miss Sylvia Correa at the Information Desk at PRNC. For others, buses will be available for the return trip to the Da Vinci.

Telephone Numbers:

U.S. AEC Puerto Rico Area Office	767-2004
Puerto Rico Nuclear Center, Río Piedras	767-0350
Puerto Rico Nuclear Center, Mayaguez	832-1414
Da Vinci Hotel	725-2323