

PRNC 88 PUERTO RICO NUCLEAR CENTER PROGRAM AND ABSTRACTS U.S. ATOMIC ENERGY COMMISSION ~ DIVISION OF BIOLOGY AND MEDICINE BIOMEDICAL PROGRAM DIRECTORS MEETING SAN JUAN, PUERTO RICO FEBRUARY 8-9, 1965 'OPERATED BY UNIVERSITY OF PUERTO RICO UNDER CONTRACT NO. AT (40sl-1893 FOR U.S. ATOMIC ENERGY COMMISSION. ---Page Break--- PROGRAM AND ABSTRACTS FOR THE U.S. ATOMIC ENERGY COMMISSION - DIVISION OF BIOLOGY AND MEDICINE 'BIOMEDICAL PROGRAM DIRECTORS MEETING SAN JUAN, PUERTO RICO FEBRUARY 29, 1955 ---Page Break--- TABLE OF CONTENTS 'PROGRAM ABSTRACTS Terrestrial Ecology Program, Part I Terrestrial Ecology Program, Part II Schistosomiasis Program Medical Sciences & Radiobiology Division Resonance in Radiation Effects Program Radiotherapy and Cancer Division Nuclear Power Program of Puerto Rico (Civil Defense in Puerto Rico Clinical Applications Division Agricultural Bio-Sciences Division Radiotracers Division Organic Chemistry Project Radiation Chemistry and Photochemistry Marine Biology Program Sugar Cane Borer Project BIOGRAPHICAL SKETCHES OF PRNC PARTICIPANTS Bugher, John C.; Cobas, Anador; Daniels, Nelio; Goldberg, Henry J.; Inuiarry, Sergio; Towman, Frank O.; Suse, Robert A.; Marcial, Victor A.; Odum, Howard T.; Roig, Havin; Sonant, Harry; Walker, David W.; Weinbren, M. Paul SELECTED PHOTOS OF PRC LIST OF PARTICIPANTS. LIST OF PRNC PERSONNEL (ORGANIZATION CHART - PRNC F 10-12 13-16 17-19 20-21 22-23 24-25 26-27 28-29 ---Page Break--- U.S. ATOMIC ENERGY COMMISSION - DIVISION OF BIOLOGY AND MEDICINE BIOMEDICAL PROGRAM DIRECTORS MEETING San Juan, Puerto Rico February 8, 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, N.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 Paul Weinbren, M.D. Schistosomiasis Program Medical Science & Radiobiology Division Resonance in Radiation Effects Program Henry J. Goldberg, Ph.D. 11:30-12:00 P.M.

22h5 P.M, Radiotherapy and Cancer Division Victor A. Marcial, sD. 2ih5= 3:15 P.M. Maclear Power Program of Puerto Rico Motesto Iriarte, Ph.D. Puerto Rico Water Resources Authority 3215+ 3:05 P.M., Civil Defense in Puerto Rico Juan César Cordero Major General U.S. Army 3:h5~ 4:00 P.M., Coffee Break 4200+ UzI's P.M. Tour of Bio-Medical Building Amador Cobas, Ph.D. ---Page Break--- SUNDAY, February 9 Puerto Rico Nuclear Center - Río Piedras 8:30-9:00 A.M. 9:00-9:30 A.M. 9:30-10:15 A.M, 10:15-10:30 A.M, 10:30-11 11:30-11:50 A.M, 12:50-1:00 P.M. 12:00+ 3:00 P.M. Clinical Applications Division Agricultural Bio-Sciences Division Radioteotopes Division Organic Chemistry Radiation Chemistry & Photochemistry Coffee Break Marine Biology Program Sugar Cane Borer Project Sandwiches & coffee to be served Executive Session Sergio Irizarry, M.D. Robert A. Lase, Ph.D. Bavin Roig, Ph.D. H. Harry Smzant, Ph.D. Malcolm Daniels, Ph.D. Frank Lowman, Ph.D. David Walker, Ph.D. Division of Biology and Medicine ---Page Break--- TERRESTRIAL BIOLOGY PROGRAM, PART I TITLE: The Rain Forest Project INVESTIGATORS: Howard T. Odum, Ph.D., Chief Scientist I, Principal Investigators Francie 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 435 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, 1955, and the 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. ---Page Break---

TERRESTRIAL BIOLOGY 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; Aguétin 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 the tropical rain forest of exposure to a 10 Kilocurie Cobalt-60 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 genetic material with that of the arthropod host. Current status: The preliminary investigations are now necessarily completed because exposure has started. To date, 229 rates have been trapped a total of 1,102 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. Paul Weinbren, M.D., paper presented at the Seventh International Congress of Hospital Medicine and Malaria, Rio de Janeiro, Brazil, September, 1963. ---Page Break---

Virus Studies conducted in the laboratories of the Puerto Rico Nuclear Center by the combined team (Puerto Rico Nuclear Agency, Puerto Rico Department of Health, Communicable Disease Tester), Agustin Cajigas, M.D., M. P. Weinbren, M.D., paper read at the ---Page Break---

SCHISTOSOMIASIS PROGRAM: 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 Investigator; Scientist I, Scientist II, Principal John B. Vilella, Ph.D., Associate. DATE INITIATED: December 3, 1963. PURPOSE AND SCOPE: The program is based upon work by Drs. Vilella, Gonberg, and Gould, and on basically similar information published by Gadus et al. The different groups have produced encouraging results, but to date no quantitative 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 immunity 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. Vilella et al. employ intraperitoneal infection, and his group prefers 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 parsed, current states: State 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. ---Page Break--- MEDICAL SCIENCES & RADIOBIOLOGY DIVISION TITLE: Medical Sciences & Radiobiology Division STAFF: M. Poul Weinbren, M.D., Chief Scientist II, Heads Joha B. Vitellia, 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, 1952 being the commencement of PY1953. PURPOSE AND GOAL: 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. COMMENTARY: 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 of the cellular development of the biological effects of neutron capture by Boron; (2) a number of studies on the chromosomes in cultured human leukocytes; (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 the hospital with acute neurological syndromes. ---Page Break--- RESONANCE IN RADIATION EFFECTS PROGRAM IMB: Resonance in Radiation Effects Program

INVESTIGATORS: Henry J. Gosberg, Ph. D., Deputy Director, PRNC and Robert A. Luse, Ph. D., Associate Scientist II, with the collaboration of Florencio Wazquez, 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 on 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 the 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 variation, studies were extended to the metalloenzyme carboxypeptidase A and its related esterases. In these enzymes, the constituent metal can be removed by dialysis and is replaced by certain other metals. Accordingly, the original zinc-containing enzyme can be converted to esterases containing cobalt, nickel, tin, selenium, 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. ---Page Break--- PUBLICATIONS: "Resonance in

Radiation Effects", Gomberg, H. J., Luse, R. A., and Vazquez Martinez, F., Technical Report No. 1, FRIC-12, 1963. "Resonance in Radiation Effects", Gomberg, H. J., Luse, R. A., and Vazquez Martinez, F., Progress Summary Report No. 1, PRNC-14, 1963. "Resonance in Radiation Effects of Low Energy Monochromatic X-rays on the enzyme 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, PRIC-H0, 1964. "P-center Production with Monochromatic X-rays", Vazquez Martinez, F., presented at Conference of Nuclear Spectroscopy and Solid State Physics, Lima, Peru, February, 1964. "Resonant Action of Low Energy Monochromatic X-rays on Chromosomes Incorporated with Suberodentine", Koo, T.K., and Gomberg, H. J. (Radiation Research in press). ---Page Break---
RADIOTHERAPY AND CANCER DIVISION TITLE: Radiotherapy and Cancer Division STAFF: Victor Marcial, M.D., Chief Scientist; Heady Joub M. Tomé, M.D., Chief Scientist; Jeanne Ublifins, M.D., Associate Scientist; José N. Correa, M.D., Associate Scientist; Antonio Bosch, M.D., Associate Scientist; Graciela Maytorena Serna, M.D., Associate Scientist; Maria P. de Lozano, M.S., Research Associate; Zenaida Prissy MoS, Research Associate. DATE ESTABLISHED: 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. COMMENT 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 treatments, and to plan and conduct radiological therapy. (2) 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) Biochemical Changes in the Blood of Patients Receiving Chemotherapy for Cancer—Serum T proteins, Serum Sodium and Potassium, and Urea; (5) Study of Optimal "Dosing" of Radiation Therapy for 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 Cancers; (8) Lymphangiography in Cancer Patients: PUBLICATIONS: Patel Discussion on Mediastinal Tumors with Presentation of Cases, V. A. Molle, Oeickde Bigt® A U8 Association Néicien ae Puerto Atco", Tol. 59, Yo. 10, October 1958 "Abdominal tumors in Children" (Symposium with presentation of Cases), Bonk Marcial, Med. R.A. Marcial Rojas, M.D. B. Mirabel, Modee Ke Dioe Bonet, M.D., L.A. Diaz Bonet, M.D. Published in

"Boletín de la Asociación Médica de Puerto Rico", Yo1.51, tlo. 11, November 1959 "Some Aspects of the Base of the Tongue", V. A. Marcial, M.D., American Journal of Roentgenology 81, No. 3, HS0-i29 (1959) "Report on Tumors of Bone", V. A. Marcial, M.D., R.A. Marcial Rojas, Publicación Secanónica M.D. J. Dévila López, M.D. E. Pérez Santiago, M.D., published in "Boletín de la Asociación Médica de Puerto Rico", Yet 5 Tlo. 2, February 1959, "Cancer Morbidity in Puerto Rico",

V. A. Marcial, M.D., Acta Unita Internationales Contra Cancerum, July 1960 "Socioeconomic 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 1965, "Our Cancer Problems", V.A. Marcial, M.D., "Boletín de la Asociación Médica de Puerto Rico", October 1962 "Twenty Years Experience in Exfoliative Cytology in Puerto Rico", V.A. Marcial, M.D., O. García Ramírez, M.D. and S. A. Forster, "Boletín de la Asociación Médica de Puerto Rico", Vol. 3B, No. 9, Pages 209-293, September 1962 "Cancer Control in Puerto Rico", V.A. Marcial, M.D., Radiología Clínica 33:39-46 (1968) ---Page Break--- 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 the Coast Station, a nation plant is being considered for the South. 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. The combination nuclear power and desalination plant is being considered. No detailed work or consideration has been given yet pending 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. ---Page Break--- TITLE: Civil Defense in Puerto Rico PURPOSE AND SCOPE: The Office of the Civil Defence of the Commonwealth of Puerto Rico operates directly from the Office of the Governor. It derives its authority from procedural guidance from appropriate Federal Legislation and specifically from Puerto Rico Public Law 183, 1 May 1951, as amended by the legislature of the Commonwealth. For the purposes of national supervision and guidance, Puerto Rico is located in Region One, Office of Civil Defence. Regional Offices at Beverly, 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 Defence 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, 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.

cubic citizens 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 Municipal Representative in each Municipality, normally a Government Agency Official, to ensure 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 program, 2. A island-wide program of alert systems, early warning and communications networks, supplemented by alternate warning and communications methods which may include amateur short wave length radio operators, -33- ---Page Break--- 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 ensuring 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. =e --- Page Break --- (CLINICAL APPLICATIONS DIVISION TITLE: Clinical

Applications Division STAFF: Sergio Irizarry, M.D., Chief Scientist II, Heads Aldo B. Lanaro, N.D., Associate Scientist. 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 use of radioisotopes in medicine. CURRENT STATUS: (A) During the past six months, 1,900 diagnostic procedures were performed on 1,160 patients from the University Hospital, the San Juan City Hospital, the Rio Piedras Municipal Hospital, the Dr. González Martínez Oncology 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. The main purpose is to emphasize training in the use of clinical radioisotope techniques. Orientation Course Clinical Applications of Radioisotopes for Medical Students. This is a non-credit seminar course designed for orientation only in the medical uses of radioisotopes. Orientation Course Clinical Use of Radioisotopes for Medical Practitioners. This is a course for general practitioners and doctors in other medical specialties, 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. ---Page Break--- Training in Clinical Research. This course stresses research aspects in Clinical Medicine and is designed to provide research facilities to trainees interested in clinical radioisotope research work. (C) Research. To complement the training program, research projects in the areas indicated are

active, following 'Thyroid Research Program: Clinical Studies of Thyroid Function. (a) In Vitro tests of thyroid function; (b) Autocontraceptives and THYROID uptake of 2013 (c) evaluation of the 2-hour I-131 Thyroid Uptake; (d) bore relation thyroid can with histopathology; (e) 24 to 48 hour I-131 uptake and tagged hormones. Cardiovascular Studies of cardiovascular the Cervix; (f) Cardiovascular Function - The Renogram in Cancer of the Cervix in Diabetes; (g) Renal, Stereotactic Tract and Liver Repair Program gastrointestinal and hepatic function. Patient Absorption. Phase I - during radiation. Phase 2 - after radiation; (h) Thyroid Gland as an indicator of intestinal absorption; (i) Rose Bengal I-131 localization and dynamic studies. Isotopic Localization Research Program: Tumor Localization and Improvement of Diagnostic Apparatus. (a) Toxicity and Safety of Radioisotopes and tumor localization. Radioisotope Therapy Research Program: Review

of Patients treated with "Renogram in Cancer of the Cervix", S. Irizarry, M.D., As Le Rodriguez Rosado, M.D., PRIC~33- ---Page Break--- AGRICULTURAL BIO-SCIENCES DIVISION TITLE: Agricultural Bio-Sciences Division STAFF: Robert A. Luce, Ph.D., Associate Scientist, Head; Diane B. Linden, Ph.D., Associate Scientist II; Francis K. Koo, Ph.D., Associate Scientist II; Andres Marezsi, Ph.D., Associate Scientist; David Welker, Ph.D., Associate Scientist; J. Holden, 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) State offers courses which support advanced work: Cytogenetics, Advanced Genetics, Biochemistry of the Cell 3) State 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 thests (B) Research, 1) Effects of ionizing radiation on the genetic, physiology, and biochemistry of plants which are important economically to the tropics. Issue: Can high sucrose mutants 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 weeks old. What are the cytogenetic effects of neutron irradiation in sugarcane? Marezski: 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. ---Page Break--- Linden: What is the radiation response of the genetic phenomenon of paramutation? Both regulatory gene and site of action found. Parental phenotypic alterations have persisted for two generations. Paramutation is hypothesized as an inactivation event, not true mutational change. 2) Amplification of radioisotopes 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 stands. Roldan: Applied practice and techniques to standard fertilization deficiencies, preservation of tropical fruits, and pasteurization. Tables by radiation. Linden: Canna radiation at 200K: Level changes for 30 days at 50°C storage. Grane: To study changes in vitamin levels in gamma-irradiated mangos. (C) Cooperative program 1) Service gamma irradiation with Co-60 source in India. Cuevas: Several hundred samples irradiated last year. 2) US-ABC Exhibit in Central America, Starr serves as agricultural consultants. PUBLICATIONS: "A Mechanism for Radiation-Induced Back Mutation", F.X.8. Koo, Second International Congress of Radiation Research, Abstract, p. 234, August 150. "Biological Effect Produced by X-Rays and Thermal Neutrons in Diploid and Hexaploid Species of Avena", F.K.8. Koo, Radiation Biology, (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, (25) 406-408, Galy-mgier, 1962. = 18 - ---Page Break--- Nutritional Factors Stimulating the Formation of Lysine Decarboxylase in Escherichia Coli", A. Marezsii and M.7. Nalete, Journal of Bacteriology (83) 1204726, April, 1962. "Polygenic Variability induced by Thermal Neutron Irradiation", F.K.8. Koo, Radiation Research (16) 501, Abstract, 1962. "Additional Sources in Parameteration Indy (48) July, 1953. "Effects of Radiation on Parameteration May, 1963. Ability", D.B. Linden, Genetics ') D-B. Linden, Radiation Research (19) Mechanisms 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.E.8. Koo, Science, July 19, 1963. "Agricultural Applications of the Puerto Rico Nuclear Center Co@ Gamma Irradiation Facility", J. Cuevas and D.B. Linden, presented at Caribbean Food Crops Society meeting, San Juan, October,

1956. "Radiation Pasteurization of Mangoes", D.B. Linden, *ibid*, "Effects of Co60 Gamma Irradiation on Corn Pollen", V. Roarfger 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.?, Asenjo), presented at Third Caribbean Chemical Symposium, Caracas, January, 1965. 19 ---Page Break---

RADIOISOTOPES DIVISION TITLE; Radioisotopes Division STAFF: Avin Roig, Ph.D., Chief Scientist; H. Harcy Samant, Ph.D., Chief Scientist II; Malcolm Daniels, Ph.D., Associate Scientist II; José Castritida, Ph.D., Associate Scientist I; Rosa Santana de Tivedo, M.S., Research Associate I

DATE INITIATED: August 19, 1957 PURPOSE AND SCOPE: The main objective of the program is the training of sufficient 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 FRI. CURRENT STATUS: (A) Courses receiving University credit: Basic Course in Radioisotope Techniques (Chemistry and Veterinary Science ~ Prerequisite courses). 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 65 - 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 - credit hours). A one-semester course offered once a year for advanced undergraduate students. Approximate enrollment: 4 to 6. Radioisotope Applications in Organic Chemistry (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. ---Page Break---

PUBLICATIONS: The lecture material used in the Basic Course in Radioisotope Techniques is being compiled and will be published in two volumes. -a- ---Page Break---

ORGANIC CHEMISTRY RESEARCH PROJECT SUMMARY: Chemistry Research Project INVESTIGATORS: H. Harry Suant, Ph.D., Chief Scientist 12, Principal Investigator; José Castrillén, Ph.D., Associate Scientist 7 and II Research Assistants and Graduate Students. Certain parts of the Project count with the collaboration of Bawin Roig, Ph.D., Chief Scientist 21; 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 STAN: '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 phosphonic 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 polyhydroxy 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 diethyl 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 2,1-Diarylethanes", H. K. Samant and J. F. Definer, *J. Am. Chem. Soc.*, 81, 9558 (1959) ---Page Break---

"Glycolate Derivatives of Dihydrone

and Glycols", Honor Program Thesis, August, 1953, "Base-Catalyzed Formation of Imidates" by H. H. Samant and B. P. Olavarria, PRIC-20 and M.S. Thesis of B.P. Olavarria, August, 1963. "The Wolff-Kishner Reaction of Hydrazones" by H. H. Samant and O. M. Harmuth, J. Am. Chem. Soc., 6, 2909 (1964). "A Study of the Reaction of Triphenyl Phosphine and Sulfoxides", M.S. Thesis of O. Cox, August, 1954. "High-Efficiency Reduction of Sulfoxides by Triphenyl Phosphine and Carbon Tetrachloride", H. H. Samant and J. Castrillón, J. Org. Chem., in press. "The Self-Association of Dimethyl Sulfoxide", R. Pigueroa, E. Roig, and H. K. Samant, Spectrochim. Acta, in press. ~ 3
---Page Break--- 'PHOTOCHEMISTRY AND RADIATION:

Photochemistry and Radiation Chemistry Project INVESTIGATORS: Malcolm Daniels, Ph.D., Associate Scientist; Alec Grimson, Ph.D., Associate Scientist, Ad-Honorem; Bri Wig, Ph.D., Holarch, Associate, Ad-Honorem. DATE INITIATED: NIM support March 1, 1962; USAS Division of Biology and Medicine support, January, 1963. PURPOSE AND SCOPE: (a) Investigation of the 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 DNA and its constituents in aqueous solution. CURRENT STATUS: (a) Photolysis of aqueous thymine solution of 18494 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 nm in aqueous solution, i.e., via the $^1M7 +$ excited states. The effects of concentration, intensity, pH, and oxygen have been investigated, as well as the inhibition by nitrate, and scavenging by 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 fluorescence of aqueous solutions of heterocyclic components of D.N.A. has been investigated. A previously unreported fluorescence from cytosine has been characterized. Similar work has been carried out on thymine and adenine. Cytosine has been found to undergo biologically important photochemical deamination at 253 nm. The kinetics of deamination have been determined and correlated with the kinetics of self-quenching of...

Break--- 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; luminescence has been observed from DNA in aqueous solution, and deamination is found to occur at 207 nm. This work is being actively prosecuted; a preliminary account has been presented at the International Congress of Photobiology, Oxford, 1961, 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. 65, 1475 (1958) "Photochemically-Induced Oxidation of Arsenite: of Arsenic (III)", M. Daniels, J. of Phys. Chem. 6, 1673 (1968) "Photochemistry of Thymine", M. Daniels and Alec Grinson, Nature, 484 (1953) "The Deuterium Isotope Effect in the Hydrogen Bonding of Imidazole in Naphthalene Solutions", Alec Grinson, J. of Phys. Chem. Vol. 962 (1963) "Fluorescence of Cytosine in Aqueous Solutions", M. Daniels and Alec Grinson, PRIC 42, July 1964 "The Photochemical Deamination of Cytosine at 2537 Å", M. Daniels and Alec Grinson, 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 2867 (1964) ~ 35 ---Page Break---
MARINE BIOLOGY PROGRAM TITLE: Marine Biology Program INVESTIGATORS: Frank G.

Lowman, Ph.D., Chief Scientist I, Principal Investigator Robert A. Stevenson, Ph.D., Associate Biologist 1; D. K. Puepps, Ph.D., Associate Enrique Avila, M.S., Research Associate 1; 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

fund 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 depth 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 elements 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. ---Page Break--- PUBLICATIONS: "Marine Biology - Progress Summary Report I", F. G. Loman, PRNC 15, (1963). "Activation Analysis in Marine Biology", J. G. Lowman, International Atomic Energy Agency ~ Proceedings of the Study Group Meeting on the Utilization of Research Reactors held at Sao Paulo, Brazil, Nov. 28, 1963. "Trace Element Analysis of Some Marine Organisms", by R. A. Steventon, B. Ingo 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. Toman, L. Quiñones, M. Miré, I. Oliver de Padovani, B. Ranos, V. Ronin de Vega and J. 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. Min, submitted to *Analytica Chimica Acta*, to be submitted "Scandium Analysis in Sea Water", V. Ronda de Vega, et al., to be submitted to *Journal of Marine Research*, eT ---Page Break--- SUGAR CANE BORER PROPOSAL 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 the 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 eradicated 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 renders 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 x? and below. (5) Exposures to 8 KR, 10 KR, 12 KR and higher cause SOS mortality and higher to larval status and pupae of less than 5 years of age. Ictal dosage and sterilizing dosage are equal in innate nature. (3) Artificially rearing food media have been developed which prolonged adult lifespan 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. (6) Mating Behavior. Mating takes place in the dark and under laboratory conditions newly emerged adults will mate at any time if placed in an area. In nature, mating takes place as early as 8:00 PM, and still 10 AM. The female attracts the male by a chemical sex attractant, (pheromone) secreted by glands on the ventral side of the eighth abdominal segment. Males search for females by an erratic flight pattern. Upon locating the female, a brisk courtship behavior ensues and is followed by copulation. ---Page Break--- () Work in progress includes: (2) Developed and includes food medium of low cost. (2) Development of a hybrid line of this species having short larval lifespan, long adult lifespan, 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 occurring individuals (in the leads) of mass-rearing methods. (2) Future work with the lines: (2) 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 effects produced (sperm death, sperm inactivation and somatic degeneration). (2) Assessment of the effectiveness of treated males for competing with natural males for mates under laboratory and field conditions. (3) A study of laboratory and field population dynamics during and after release of.

invasiated anise, PUBLICATIONS: "Biology of *Diatraea saccharalis* (FAB.) in Puerto Rico III Oviposition Rate", D. SyWelker, and M. Figueroa, *Annals Entomological Society of America*, 57 (6): 515-516, 1968 "Biology of *Diatraea saccharalis* (FAB.) A description of the mating behavior", D. W. Walker, *Proc. Entomological Society of Washington*, to appear March, 1955. ---Page Break--- BUGHER, JOHN C. Director, Puerto Rico Nuclear Center Professor of Pathology PIED: Pathology EDUCATION: B.S., Taylor University, 1921; A.B., University of Michigan, 1921; M.D., University of Michigan, 1925; S. University of Michigan, 1931; Hon. S.D., Taylor University, 1953; Hon. Sc.D., University of Michigan, 1964, EXPERIENCE: Instructor, Mathematics and Physics, Taylor University, 1919-2050; Assistant in Bacteriology, University of Michigan, 1922-25; 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, Columbia, 1937-43; Director, Yellow Fever Institute, Lagos, Nigeria, West Africa, 1943-55; '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 2, 1964 to present. + Dr. Bugher is on loan to Puerto Rico Nuclear Center from Rockefeller Foundation. ---Page Break--- COBAS, AMADOR Associate Director, Puerto Rico Nuclear Center Professor of Physics EDUCATION: B.A., (Physics), University of Puerto Rico, 1938; Graduate work

in Physics including courses on Radioactivity under Madame Curie, 1935; M.A. (Physics), Columbia University, 1940; Ph.D. (Physics), Columbia University, 1948, EXPERIENCE: Assistant

Instructor Physical Sciences, University of Puerto Rico, 1933; Instructor Physical Sciences, University of Puerto Rico, 1937-39; Resident Fellow, Columbia University, 1939-40; Assistant Professor of Physics, University of Puerto Rico, 1940-41; Lecturer in Physics, Columbia University, 1941-43; Associate Professor of Physics and Head Department of Physics, University of Puerto Rico, 1947; Professor of Physics and Head Department of Physics, University of Puerto Rico, 1947-195; Research Associate, New York University, 1947-195; 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, 1950 to present. one ---Page Break --- DANTEIS, MALCOUL Radiation Chemistry & Photochemistry Project Radioisotopes Division Associate Scientist TT FIBID: 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, 1957; 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. ---Page Break --- CONBERG, MY J. Deputy Director, Puerto Rico Nuclear Center Professor of Physics FIELD: Electrical Engineering EDUCATION: B. S., City College of New York; M. S., (Electrical Engineering), University of Michigan, 1942; Ph. D. (Electrical Engineering), University of Michigan, 1951. EXPERIENCE: Detector Scales, 1936-37; General

Switlen Corporation, 1: AIA Instructor and Research Associate on High Frequency Electrical Energy, 1911-1955 Civilian and Officer, Naval Ordnance Laboratory, 1913-1955 Assistant Professor, Associate Professor, Professor and Chairman of Department of Nuclear Engineering, University of Michigan, 1986; Research Associate, Laboratory Supervisor, Assistant Director, Director, Michigan Memorial Phoenix Project on Fission Atomic Energy, 1946; Consultant to: Argonne National Laboratory-Reactor Division and Remote Control Division, U.S. Atomic Energy Commission Office of Isotope Development, International Cooperation 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. 3. ---Page Break--- IRIZARRY RIVERA, SERGIO Head, Clinical Applications Division Chief Scientist II Clinical Associate in Medicine FIBID: Internal Medicine EDUCATION: B.S., University of Puerto Rico, 1916; 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. T. 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, 1950 to present. =u ---Page Break--- WOMAN, FRANK O. Director, Marine Biology Program Chief Scientist. FIELD: Radiobiology EDUCATION: B.S., University of Washington, 1948; Ph.D. (Marine Biology) University of Washington, 1956. EXPERIENCE:

Research Assistant,

Laboratory of Radiation Biology, 1918-53; 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, Bikini 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. ---Page Break---
USE, 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; Agricultural Bio-Sciences Division, Puerto Rico Nuclear Center, November, 1964 to present. ---Page Break---
MARTIAL, VICTOR Head, Radiotherapy & Cancer Division Scientist I, Professor of Radiation Therapy FIELD: Radiation Therapy of Cancer EDUCATION: B.S., University of Puerto Rico, 1948; M.D., Harvard Medical School, 1949. EXPERIENCE: Intern, Bayamón District Hospital, 1949-50; General Practice of Medicine, 1950-52; 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 Toro 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.

Martinez Oncologic Hospital; Head, Radiotherapy and Cancer Division, Puerto Rico Nuclear Center, 1958 to present. ---Page Break---
COM, HOWARD. Director, Terrestrial Ecology Program I: The Rain Forest Project, Chief Scientist. FIELD: Ecology, Oceanography. EDUCATION: Cadet Meteorology, Technical Training Command, USAAF, 1943; 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, 1942-45; Instructor, Tropical Weather School, Canal Zone, 1945; Teaching Assistant, Yale University, 1967-68; Assistant Professor, University of Florida, 1950-54; Eniwetok Research, 1964; 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, 1953 to present. Director, Terrestrial Ecology Program I: The Rain Forest Project, Puerto Rico Nuclear Center, 1963 to present. ---Page Break---
ROIG VALDIVIESO, EDWIN. Head, Radioisotopes Division. Chief Scientist. Professor of Chemistry. EDUCATION: B.S., Chemistry, University of Puerto Rico, 1948; 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, 1951-57; 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. -»- ---Page Break--- SOMANT, H. HARRY Organic Chemistry Project Radioisotopes Division Chief Scientist IT Professor of Chemistry FIELD: Organic Chemistry EDUCATION: B.A., Ohio State University, 1940; Ph.D., Purdue University, 1948. EXPERIENCE: Research Chemist, Monsanto Chemical Company, 1946-66; Associate Professor and Professor, Duquesne University, 1916-56; Director, Center of Chemical Research, University of Oriente, Santiago de Cuba, 1958-61; Professor of Chemistry, University of Puerto Rico, and Chief Scientist, Radioisotope Applications Division, Puerto Rico Nuclear Center, 1961 to present. = ho = ---Page Break--- WALKER, DAVID #. Soger Gane Borer Program Agricultural Bio-Sciences Division Associate Scientist 5T Associate Professor of Zoology FIELD: Entomology EDUCATION: B.S., Public Health and Preventive Medicine, University of Washington, Seattle, 1950; M.S., (Entomology), Washington State University, 1952; 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 J alas Land Project, 1954 to present; Associate Scientist II, Agricultural Bio-Sciences Division, Puerto Rico Nuclear Center, 1963 to present. oe ---Page Break--- WBDIBREN, MAURICE PAUL Head, Medical

Sciences & Radiobiology Division Chief Scientist IT FIELD: Microbiology EDUCATION: B.Sc., (Histology & Physiological Chemistry), 1916; B.Sc., Hons (Zoology), University of Witwatersrand, Johannesburg, South Africa, 1947; M.R.C.S. (England) 1.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 Bolen, 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, 1959-61; 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. ---Page Break--- ---Page Break--- ---Page Break--- ---Page Break--- ---Page Break--- ---Page Break--- U.S. ATOMIC ENERGY COMMISSION BIOMEDICAL PROGRAM DIRECTORS MEETING February 8-9, 1955 PARTICIPANTS ANDREWS, Gould Department of Medicine Oak Ridge Institute of Nuclear Studies Oak Ridge, Tennessee BARR, Nathaniel Division of Biology & Medicine U.S. Atomic Energy Commission Washington, D.C. 20545 BLAIR, Henry A. Atomic Energy Project University of Rochester P. O. Box 287, Sta. 3 Rochester, W.V. BOND, Victor P. Chairman,

Medical Department Brookhaven National Laboratory Upton L.I., N.Y. BRUNER, H. D. Division of Biology & Medicine U.S. Atomic Energy Commission Washington, D.C. 20545 BUGHER, John C. Director, Puerto Rico Nuclear Center Bio-Medical Building Csparra Heights Station San Juan, Puerto Rico BURR, W. W. Division of Biology & Medicine U.S. Atomic Energy Commission Washington, D.C. 20555 CHIRICO, Jorge ABC Agricultural Research Laboratory University of Tennessee 1299 Bethel Valley Road Oak Ridge, Tennessee CLAUS, Walter D. Division of Biology & Medicine U.S. Atomic Energy Commission Washington, D.C. 20545 COWAN, Frederick P. Health Instrumentation & Physics Dept. Brookhaven National Laboratory Upton L.I., N.Y. CURETS, Foware J. Chatman, Biology Department Brookhaven National Laboratory Upton L.I., KY. DAVIS, Jared J. Division of Biology & Medicine U.S. Atomic Energy Commission Washington, D.C. 20545 DEAL, J. Joo Division of Biology & Medicine U.S. Atomic Energy Commission Washington, D.C. 20545 DONALDSON, Lauren R. Director, Laboratory of Radiation Biology University of Washington Seattle, WA 98195 DUDA, George D. Division of Biology & Medicine U.S. Atomic Energy Commission Washington, D.C. 20505 DURHAM, Charles L. Director, Division of Biology & Medicine U.S. Atomic Energy Commission Washington, D.C. 20545 ---Page Break--- HINO, Rosemary Division of Biology & Medicine U.S. Atomic Energy Commission Washington, D.C. 20515 ENGWIND, Kenneth I. Richland Operations Office U.S. Atomic Energy Commission P. O. Box 550 Richland, Washington GARDINER, Donald X. Health & Safety Division Chicago Operations Office U.S. Atomic Energy Commission 9800 South Cass Avenue Argonne, Illinois GOPMAK, John W. Lawrence Radiation Laboratory University of California, P. O. Box 808 Livermore, California RAEI, Douglas Div. of Biological & Medical Research Argonne National Laboratory 9700 South Cass Avenue HALL, Nathan B. Director, ABC Agricultural Research Lab. University of Tennessee 1299 Bethel Valley Road Oak Ridge, Tennessee HARLEY, John I.

Director, Health & Safety Laboratory New York Operations Office U.S. Atomic Energy Commission 376 Hudson Street New York, N.Y. HARPER, Paul V. Argonne Cancer Research Hospital University of Chicago 950 E. 59th Street Chicago, Illinois HORDE, Karl E. Savannah River Operations Office U.S. Atomic Energy Commission P.O. Box A Aiken, South Carolina HOLLABIDER, Alexander Chairman, Biology Division Oak Ridge National Laboratory Oak Ridge, Tennessee HUDSON, Miller K. ABC Scientific Rep. Atomic Energy of Canada, Ltd. Chalk River, Ontario, Canada JACOBSON, Leon O. Director, Argonne Cancer Research Hospital University of Chicago 950 E. 59th Street Chicago, Illinois JONES, Hardin B. Donner Laboratory Lawrence Radiation Laboratory University of California, Berkeley, California. KELLER, R. Davidson Engineer, Puerto Rico Area Office U.S. Atomic Energy Commission P.O. Box 8 Bayamon, Puerto Rico KORNBERG, H. A. Battelle Memorial Institute Pacific Northwest Laboratories P.O. Box 999 Richland, Washington TANG, Anton Division of Biology California Institute of Technology Pasadena, California TANOHAM, Weight H. Los Alamos Scientific Laboratory P.O. Box 1663, Los Alamos, New Mexico ---Page Break--- LAWRENCE, John X. Donner Laboratory Lawrence Radiation Laboratory University of California, Berkeley, California, BOUGH, Atlan B. Division of Biology & Medicine U.S. Atomic Energy Commission Washington, D.C. 20545 WSHRAUGH, C. C., Department of Medicine Oak Ridge Institute of Nuclear Studies Oak Ridge, Tennessee MARIELLE, Leonidas D. Radiological Physics Division Argonne National Laboratory 9700 S. Cass Avenue Argonne, Illinois MARKO, Anthony Biology & Health Physics Division Atomic Energy of Canada, Ltd. Chalk River, Ontario, Canada MINKLER, Jason Lawrence Radiation Laboratory University of California P.O. Box 808 Livermore, California MORGAN, Karl Z., Health Physics Division Oak Ridge National Laboratory Oak Ridge, Tennessee YGAARD, Osavar Atomic Energy Project Western Reserve University Cleveland, Ohio PLACE, Cameron Biology & Health Physics

CLINICAL RADIOISOTOPES DIVISION Chief Scientist H. R. Colén. Research Technician Associate Scientist R. Rodríguez. Research Technician Research Technician L. G. Meves. Research Technician Research Technician 2D, Sealera. Technical Assistant Research Technician B.L. Gatsérees. Research Technician B.L. Rodríguez. Technical Assistant Technical Assistant AGRICULTURAL BIOSCIENCES DIVISION Scientist A. García, D.S. Lindens Research Technician R. A. Iuse. Scientist C. Ly Tereles. Research Technician F. K. B, Koo. Scientist X. Mrex. Research Technician A.L. Maret Scientist Y.B. Medina. Technical Assistant D. Walker. Scientist G. Hernández. Gardener F. Padovan D. Valentin. Laborer MEDICAL SCIENCE & RADIOBIOLOGY DIVISION M. B. Weinbren. Chief Scientist S. J. de Jeais. Research Assistant J.B. Villella, Associate Scientist A.L. V. Schifo. Research Assistant B.L.M. Weinbren, Associate Scientist W. Rosaly. Research Technician ---Page Break--- MEDICAL SCIENCE & RADIOBIOLOGY DIVISION continued! A. Santiago. Research Technician C. Carrasquillo. Research Technician T. Véaguer. Research Technician J. Oliver. Research Technician Research Technician NUCLEAR ENGINEERING DIVISION J. G. de Quevedo. Chief Scientist C. Wheeler. Research Associate D. Saescer. Chief Scientist L. Véequee. Research Assistant P. Osborn. Chief Scientist Research Assistant K. Soderstrom. Research Associate Administrative Assistant INTERNATIONAL REBOOT PROGRAM F. Muñoz. Research Associate W.N. Arvezay. Technical Assistant S. Diaz. Research Assistant MARINE BIOLOGY PROGRAM Chief Scientist D. S. Erdman. Research Assistant Associate Scientist Associate Scientist R.L. Y. Davie. Research Associate B. Iper. Research Associate N. de Toro. Research Assistant E.B. Jusine. Research Assistant B.L. Zapet. Technical Assistant Research Assistant M.S. Cruz. Technical Assistant Research Assistant.

Kimenia, 1110 Watehman [Research Assistant a Student Assistant 'Research Assistant i Capt. a Maxhinket 'Technical Assistant 'Technical Assist wt ERMESTRIAL ECOLOGY PROGRAM - PART I Chief Scientist ©. Venator...+.+Research Assistant LK. 8. Roo... Associate Scientist AL J. Correa.--Administrative Asst. 'Associate Scientist M. ag Arce.....-Research Technician AL Estrada..... Technical Assistant 3. Martinez. .2. Technical Assistant D. Martinez. .11Technical Assistant E. Rivera:s.s. Technical Assistant J. Rui. Technical Assistant 55 ---Page Break--- TERRESTRIAL ZOOLOGY PROGRAM . PART I (continued) M. Parpilia.....Technical Assistant A. Rogsy.....--Student Assistant J. Neleezav2s 1: Technical Assistant 2 Diazesses cst :Student Assistant J. Rogario,.\. Technical Assistant [RESONANCE IN SEDIMENTATION EFFECTS PROGRAM, sAeaoet 2 Scientist "Research Associate Sl. Pereicg.-Research Technician Laboratory Assistant Vstudent: Assistant RADIATION CHEMISTRY & PHOTOCHEMISTRY PROGRAM M. Daniels... --Associate Scientist E. Belardo.....cResearch Assistant "Research Technician [PARAMUTATION PROGRAM -Associate Scientist 'Research Assistant D. B. Linden, J. Cuevas. * F. Montatve.... laborer 8. Valen 'TERRESTRIAL BIOLOGY PROGRAM - PART II Circling.....Research Assistant : M. Jimines.-Research Technician : Conga. Research Technician . Montai Mecasica: Assistant ae J Mechanical Assistant 'Technical Assistant J. Vitelia.... Associate Scientist PL Liard.....:s-Research Assistant a x College Research Technician SUGAR CANE BORER PROGRAM ssAssociate Scientist: V. Quintana. cUTkesearen Assistant ---Page Break--- NEUTRON DIFFRACTION PROGRAM M. I. Kay..s+..Chief Scientist I. Almodovar+ 'Associate Scientist HL J. Blelen... Associate Scientist sAssociate Scientist 3. uM X zB B. Cruz....+.Research Assistant Véquez.:<1 Technical Assistant sTechnical Assistant 'Laboratory Assistant SOLID STATE PHYSICS PROGRAM 8. 2. Woks: P. Richardson. .Research Assistant ++s-Associate Scientist -5T- a Chslverus....Student Assistant ---Page Break--- PRERTO RCO NUCLEAR

CENTER Announcement To: PensciveL: 262 'Recommendation Outer Review CONTRACTOR: UNIVERSITY OF PR, SEPTEMBER, 1964 Gemnon Puerto Rico OPERATIONS + MK RIDE

CONTRACT NO. 2 AT=(40=-/1889 DaTon Je bom 7 MARINE BLY yy ---Page Break--- 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 21:30 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 where they would like. Return mimeographed form to Miss Correa at the Information Desk. 2. To indicate that Gylvie will be glad to reconfirm travel reservations, etc. For groups who plan to depart on Tuesday afternoon, they should bring letters to her if they plan to go to the airport directly from the Center so that we may plan special transportation for them. 3. Field trips—Olge Dias will be at the Field Trip desk, and will arrange for those interested in going to Mayagüez on Wednesday. 4. You may wish to announce the amount of money that is to be collected: \$10 for a man alone; \$25 if a wife is taken to Caribe Monday night. My 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 so Miss Marta de Arce -- white tags, Mrs. Sara Jean de Jens -- green tags, Miss Zenaida Frias -- pink tags, Miss Irma Vazquez -- yellow tags. ---Page Break--- 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 Bartony, Subject: Tour of Bio-Medical Building 2/8/65 As agreed in Monday's meeting, February 2, 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., tour guides, identified by color badges and ribbons, will join the audience in the meeting rooms. 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 Biomedical building: Sara Joan de Jess (green tag) - Corridor leading to back exit to Chemistry Laboratory, end floor. (Radioisotopes Division - Dr. Edwin Roig) Imma Véquez (yellow tag) - First floor Lobby. (Medical Sciences and Radiobiology - Dr. Paul Welbren) Zenaida Fries (pink tag) - Corridor leading to Cancer Hospital, Radiotherapy and Cancer - Dr. Victor Narcial) 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 program (23 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: Isotopes, Clinical Applications, Medical Sciences & Radiobiology, Cancer 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 Biomedical Building. The timing of presentations and group movements are as follows: 4:00 p.m. - 1st presentation begins 4:15 p.m. - Groups move 4:20 p.m. - 2nd presentation begins 4:30 p.m. - Groups move 4:45 p.m. - 3rd presentation will end 4:50 p.m. - Groups move 5:00 p.m. - 4th presentation. U.S. ATOMIC ENERGY Commission BIOMEDICAL PROGRAM DIRECTORS MEETING February 8-9, 1965 (and Meeting)

(and Mrs) PARTICIPANTS 'AT IWE DA VINCI HOTEL 'ROOM NUMBER 'AG TUE 7, LLAWAS HOTEL BARR, Nathanfel P. (and Mrs) 531 Chiviboga, Jorge BLAIR, Henry 3a BOND, Victor P. 433 or, J. Le 232 BRUWER, He. Ta 'AX TUE OLYMPIC COURT HOTEL PURR, W. W. 637 CLAUS, Walter D. 333 Com, Frederick P. (and Mrs) 635 ANDREWS, Gould CURTIS, Howard J. 337 DAVIS, Jared J. (and Mrs) 839 DEAL, L. Joe 637 DOWALDSON, Laure R. (and Mrs) 338 DUDA,

George D. 333 AT THE HOLIDAY THM HOTEL DUNHAM, Charlee L. 332 ELMO, Rosemary 3a ERGLIND, Kenneth L. 536 WOSHBAUGH, C. C. GARDINER, Donald 4. 539 Conta, John W. 640 Aim, Douglas. 542 HALL, Nathan S. (and Mrs) 732 HARLEY, Joka H 337 HARPER, Paul V. 432 ERDE, KARL 6a HOLLAENDER, Alexander (and Mrs) 231 HUDSON, Miller NW. (and Mrs) 335, JACOBSON, Leon O. 432 KORNBERG, H. A. (and Mrs) 433, LONG, Anton 639 LANGHUM, Weight H. (and Mrs) 435, MARTUBLIT, Leontdae 237 MARKO, Anthony 636, MEUKLER, Jason 640 MORGAN, Karl 2. (and Mrs) 638, NYGARD, Oddvar 71 636 333 (and Mrs) 233 6a ROTH, Herman 533 ROTUSTEM, Aser (and Mrs) 334 ROWLAND, Robert E. (and Mrs) 541 SHIPMAN, THOMAS L. (and Mrs) 441 SHOUP, Charlee S. (and Mrs) 731 OTTER, John R. (and Mrs) 436 WHETE, Clayton 8. 339 WOLFE, John H. (and Mrs) 833, ELLE, Max R. 342 ---Page Break--- Puerto Rico Nuclear Center Operated by University of Puerto Rico for U.S. Nuclear Regulatory Commission NOTICE 70 VIVES: on Monday, February 6, several short trips have been planned. Please call Mrs. Barton at the Puerto Rico Nuclear Center (707-0350) 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 - 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 (110 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 Bacardi, that juts into the sea. Facilities at the beach include over 2,000 lockers housed in a modern concrete bathhouse. 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 lane. Parking in the adjoining lot costs 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 5:00 pm on Tuesday through Fridays, and from 2:00 pm to 6:00 pm on Mondays. 'Tour buses and colectivos leave San Juan for Luquillo Beach at various times during the day. ---Page Break--- 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 1950. 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 100 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 -- zone.

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 face-colored. La Mina Recreation Area is the jumping off spot for those wishing to climb to El Yunque peak. There are two streamed swimming pools and an excellent restaurant serving Puerto Rican dishes. Every weekend, the several trails of El Yunque are busy with small groups headed for the 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 10 minutes, with rest shelters along the way.

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Puerto Rico Nuclear Center
Operated by University of Puerto Rico
U.S. Atomic Energy Commission
U.S. ATOMIC ENERGY COMMISSION

BIO-MEDICAL PROGRAM DIRECTORS MEETING
February 0-3, 1309

The Da Vines Hotel opened officially only a few days ago and restaurant activities are still not available. However, you are near many hotels where actual early breakfasts are served. For dinner, please refer to the guide, which is enclosed in the GENERAL INFORMATION kit, for restaurants in the Metropolitan Area which you may be interested in trying.

SUNDAY, February 3365

Participants arriving before Sunday were mailed inquiries regarding their interest in Sunday field trips. Transportation to the rainforest project will leave the De Vinci Hotel at 1:00 PM. Arrangements to visit the Marsans History Museum may be made by calling the PRUC office (767-0350) on Sunday evening after 6:00 PM. The trip to Mayaguez by car is three hours one-way and 25 minutes by Caribair Airline. Participants staying after the meetings may arrange rides to Wenesday, February 9. There will be a desk outside of the

Meeting room at The Center, where these trips can be scheduled. On Monday, February 3, 1308, two buses will be parked at the Da Vinci Hotel (on Venancio street) at 7:15 AM. It is important that these buses depart on time in order to reach The Center by 8:30 AM when the program begins. PLEASE BRING THIS FOLDER WITH YOU; THE IDENTIFICATION TAG AND THE ITEMS IN THE ENCLOSED ENVELOPE ARE TO BE WORN ON ALL FIELD TRIPS AND DURING MEETINGS IN WHICH YOU PARTICIPATE. AT THE END OF YOUR VISIT, THE FUR BADGE MUST BE RETURNED TO THE PUERTO RICO NUCLEAR CENTER. Lunch on Monday will be at Cecilia's Restaurant; transportation will be provided. At 5:00 PM, the group will return by bus to the Da Vinci Hotel. You (and your wife if she is with you) are invited for cocktails and dinner at the San Geronimo Room of the Caribe Hilton at 7:30 PM, with our dinner courtesy of the Center. Dinner is "Dutch." Buses will leave from the Da Vinci at 7:15 PM and will return at the end of the evening.

---Page Break--- TUESDAY, February 9, 136. 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 Ms. Sylvia Corres at the Information Desk at PRNC. For others, buses will be available for the return trip to the Da Vinci. Telephone Numbers: ABC Puerto Rico Office 787-200 Puerto Rico Nuclear Center, Rio Piedras 767-0350 Puerto Rico Nuclear Center, Mayaguez 032-1414 Da Vinci Hotel 725-2323,

---Page Break---