

PUERTO RICO NUCLEAR CENTER

One Hundred and Eleventh Meeting of the
Advisory Committee for Biology and Medicine
to the Atomic Energy Commission

January 13, 14, 15, 1966



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PUERTO RICO NUCLEAR CENTER
Operated by
University of Puerto Rico
for
U.S. Atomic Energy Commission

ONE HUNDRED AND ELEVENTH MEETING OF THE ADVISORY COMMITTEE
FOR BIOLOGY AND MEDICINE TO THE ATOMIC ENERGY COMMISSION
January 13, 14, 15, 1966

Thursday, January 13, 1966
Bio-Medical Building - Río Piedras

8:15 a.m.	Bus leaves Condado Beach Hotel for Bio-Medical Building
9:00 a.m. - 9:30 a.m.	Program of the Puerto Rico Nuclear Center Dr. John C. Eagher
9:30 a.m. - 11:30 a.m.	Terrestrial Ecology I (Rainforest) Dr. Howard T. Odum Dr. Jerry Kline
11:30 a.m. - 12:00 noon	Terrestrial Ecology II (Virology) Dr. M. Paul Weinbren
12:00 noon	Bus leaves for El Verde* (Lunch will be provided.)
1:00 p.m. - 3:00 p.m.	Visit site
3:00 p.m.	Bus returns to Condado Beach Hotel
6:30 p.m.	Cocktails and Dinner at the "Top of the First" restaurant.

* Please dress in old clothes and wear old shoes for El Verde field trip.

Saturday, January 15, 1966
Mayaguez Laboratory

8:00 a.m.	Cars leave Mayaguez Hilton Hotel for Laboratory
8:30 a.m. - 9:30 a.m.	Marine Biology Program Dr. Frank G. Lowman
10:00 a.m. - 12:00 noon	SHIMADA field trip
12:00 noon - 2:00 p.m.	Lunch at Hotel
2:00 p.m. - 5:00 p.m.	Executive Session

Atomic Energy Commission staff attending meeting:

William R. Bibb
Medical Research Branch
Division of Biology and Medicine

Harry D. Bruner
Assistant Director for Medical and Health Research
Division of Biology and Medicine

Jared Davis
Environmental Sciences Branch
Division of Biology and Medicine

William Doran
Industrial Physician
Division of Operational Safety
Division of Biology and Medicine

Charles Dunham
Director
Division of Biology and Medicine

Hal Hollister
Chief, Technical Analysis Branch
Division of Biology and Medicine

Robert Rabson
Biology Branch
Division of Biology and Medicine

H.A. Stanwood
Assistant Director for Administration
Division of Biology and Medicine

John R. Totter
Associate Director for Research
Division of Biology and Medicine

John Wolfe
Chief, Environmental Sciences Branch
Division of Biology and Medicine

Robert Wood
Radiology Physics and Instrumentation Branch
Division of Biology and Medicine

A. W. Ziegler
Chief, Institutes and Fellowships Branch
Division of Nuclear Education & Training

Terrestrial Ecology Program, Part I

The Rain Forest

STAFF:

Howard T. Odum, Ph.D., Chief Scientist II, Principal Investigator; Francis K.S. Koo, Ph.D., Associate Scientist II; Jerry R. Kline, Ph.D., Associate Scientist I; George Drewry, Associate Scientist I; Robert F. Smith, Oak Ridge Graduate Fellow; and Visiting Scientists. H.B. Tukey, on sabbatical leave from Cornell University.

PURPOSE:

- (1) To study effects of gamma irradiation from 10,000 Curies Cesium on the Rain Forest system at El Verde.
- (2) To study hydrological balance and some mineral cycles of the rain-forest in relation to fall-out and atomic excavation.
- (3) To characterize the circuits and metabolic energy pulses of a complex terrestrial ecological system so as to understand the consequence of irradiation and fall out storage.

CURRENT STATUS:

A. Radiation Effects Studies

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 main site was irradiated for 3 months, the innermost zones receiving a million R. Post irradiation measurements are in progress showing effects of radiation according to dosage received, according to species, and according to various categories of ecological and cytological structure and function. Data emerging provide some factual basis for predicting effects of radiation on rainforests and the rates of regeneration of the living system.

Various methods for appraising effect and recovery include optical density, frog noise, microclimate, measurements of new growth; seedling growths, germination, micro-organismal populations, soil metabolism, animal populations, aerial photographs, etc.

dose exposures, and gross half lives of irradiated materials under known flux and irradiation times. In addition the identification and measurement of many elements as for example, Cu, Co, Fe, Zr, Mn, Sc, La, Na, and others can be carried out on neutron irradiated specimens. Some samples from Panama and Virgin forest of Dominica were collected for comparisons.

4. Natural Radioactivity in the environment

Preliminary surveys of soil specimens from various locations in Puerto Rico have revealed certain sites of unusually high levels of radium daughters. These sites which contain a factor of 6 more natural radioactivity than the El Verde site may be of considerable value in future studies of the behavior of radioisotopes of the Uranium decay series in natural environments.

A suggested preliminary use for these sites is to study the possibility of radon transpiration by plant by examining wood from the trees of these locations for equilibrium mixtures of lead-210 and polonium-210.

5. Leaf Leaching

Coincident with Dr. Tukey's sabbatical work here, special effort is being made to measure the leaching rates of the leaves of the rain forest trees and two species of rainforest climate agricultural species for comparison.

C. Circuits and Metabolism

A special proposal PRWC was prepared outlining the electrical analog circuits that might be prepared if authorized and budgeted.

The system on the passive principle allows for flows in 36 compartments for which there are data available to set storage constants and rates.

The work on a giant cylinder to measure forest metabolism and transpiration when the plastic tore loose in the wind after being in position 10 days. A stronger plastic has been ordered. Priorities on this experiment may go up now since the giant cylinder provides rates of transpiration for a section of rain forest, an item necessary to calculate the tritium balance in any consideration of Panama canal feasibilities.

Radioisotope Applications Division

STAFF

Edwin Roig, Ph.D., Chief Scientist II, Head; H. Harry Szmant, Ph.D., Chief Scientist II; Alec Grimison, Ph.D., Associate Scientist II (Part-Time); J.P.A. Castrillón, Ph.D., Associate Scientist I; Rosa Santana de Tirado, M.S., Research Associate I.

FORMAL INSTRUCTION

PURPOSE

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

Courses with University credit:

(1) Radiochemistry Course (Chemistry 465--4 credit hours). A one-semester course offered once a year for advanced undergraduate and graduate students. Three one-hour lectures and one four-hour laboratory period per week. Approximate enrollment: 4 to 6.

(2) Nuclear Techniques in Biological Research (Biology 372--4 credit hours). A one-semester course offered once a year for advanced undergraduate students. Three one-hour lectures and one four-hour laboratory period per week. Approximate enrollment: 4 to 6.

(3) Radioisotope Applications in Organic Chemistry-- Lecture course (2 credit hours). A one-semester graduate course to be offered for the first time the second semester of this academic year. Two one-hour lectures per week. The Radiochemistry course mentioned above is a prerequisite.

(4) Radioisotope Applications in Organic Chemistry-- Laboratory course (2 credit hours). A one-semester laboratory course to be offered for the

relations and distinctions between these. Also included are projects giving training in the use of quantum chemical calculations for evaluation of the experimental results.

CURRENT STATUS

The research topics involve studies of transient species formed by γ -irradiation of heterocyclic molecules, and trapped in rigid matrices of 77°K, and similar projects on transient species formed by photoionization and photodecomposition. The allied theoretical projects involve Molecular Orbital and Valence Bond calculations on heterocyclic molecules.

The γ -radiolysis and photolysis studies have been begun very recently, and are in their preliminary stages of measuring control absorption spectra, and determining optimum experimental conditions with systems previously studied elsewhere.

The Molecular Orbital calculations (in collaboration with Dr. W. Adam) are being actively carried out, and a large number of heterocyclic molecules have already been calculated. Valence bond calculations (in collaboration with Prof. C. Zauli, University of Bologna, Italy) in triplet states of heterocyclic molecules are in progress.

(2) In addition to applications for formal training we have received requests for informal training. As a result of this activity 4 persons have already been trained, 24 have been accepted for training, and 13 candidates are pending decision.

(3) Evidence has been obtained that many prospective trainees could come to Puerto Rico for training provided maintenance expenses could be given.

Clinical Research:

To complement the training program, research projects are active in the areas indicated:

- (1) Thyroid disorders: diagnosis and therapy.
- (2) Gastrointestinal malabsorption.
- (3) Renal disorders.
- (4) Organ and tumor localization.

(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.

An additional training activity is offered for Fourth Year Medical Students. Selected candidates receive one month of intensive in-service training, where they are exposed to cancer and radiotherapy clinical problems.

Experienced radiotherapists from Latin America are hired as visiting staff. This permits them to become acquainted with the work of this Division and to carry out research projects.

To complement the training programs, a number of research projects are active in this Division. These include: (1) Investigation of the Role of Surgical Sterilization in the Etiology of Cancer of the Uterine Cervix; (2) Study of Fractionation of Weekly Radiation Doses in Cancer Patients Under Radiotherapy; (3) Carcinoma of the Uterine Cervix Associated with Pregnancy; (4) Biochemical Changes in the Blood of Cancer Patients Receiving Radiotherapy; (5) Determination 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; (9) Exfoliative Cytology as a Tool for Determining Prognosis in Cases with Cervical Carcinoma Submitted to Irradiation; (10) Surgical Adjuvant Breast Project; (11) Study of the Incidence of Leukemia in Patients with Cervical Cancer Treated with Radiation; (12) Quantitative Fractionated Irradiation Studies in a Transplantable Mouse Chondrosarcoma; (13) Clinical Dose-Time-Fractionation Relationships.

This division is collaborating in various research projects conducted by other Divisions of PRNC.

PuBe neutron source (with 10 cm paraffin moderator) and triethanolamine borate as a tagging compound we have evolved a system with which, starting cells growing and dividing in synchrony we have established the conditions necessary to reduce the plating efficiency of the tagged and irradiated cells to half that of the controls.

A cooperative study of human chromosomes in normal individuals and those receiving radiation therapy was set up with the U.S. Army Tropical Research Medical Laboratory (C.O. Col. M. Dacquisto) and the Division of Radiotherapy but with the reorientation of the Army program and transfer of Col. Dacquisto to Washington we lost the considerable support we had been receiving from that quarter and the program has been greatly curtailed. Dr. Barbara Weinbren has assumed the responsibility for the Chromosome projects which continue, these may be divided into the following sub-sections.

- a) We are continuing the collection of specimens from Puerto Rico Nuclear Center staff to establish a reference collection.
- b) A study of the karyotypes of individuals of two distinct asthma patterns with specimens provided by Dr. J.A. de Jesús (this was the last sub-project begun with Col. Dacquisto).
- c) The study of chromosome patterns in our "normal HeLa cell cultures for comparison with those affected by Boron 10 neutron capture.
- d) Occasional clinical studies which derive from associated programs or anomalies found in our volunteers.

At one time we were cooperating in a study of the factors which bring small children into hospital with acute neurological disorders - although this was progressing well and producing very interesting results, a combination of several factors forced us to abandon our part in this program.

The DC2 chondrosarcoma brought from the National Cancer Institute by Dr. Correa has been adapted to our CFl mice and from them has been established in tissue culture where it has yielded three distinct morphological cell types which appear to be stable.

3 and 4 separate reports are given for the virus and Schistosomiasis programs.

The series of attempts to adapt the Dengue viruses, isolated during the 1963-64 epidemic, to tissue cultures has now been dropped, largely due to the fact that Dr. Wissman's group in Baltimore have achieved an adaptation to chilled baby mice.

Schistosomiasis Project

A STUDY OF THE MECHANISM OF ANTIGEN-ANTIBODY REACTIONS FOLLOWING THE INOCULATION OF MICE WITH IRRADIATED AND NORMAL SCHISTOSOMA MANSONI CERCARIAE

STAFF

M. P. Weinbren, B.Sc. (Hons), Rand, M.D., (Rand), M.R.C.S., L.R.C.P., Head, Division of Medical Sciences and Radiobiology, 1/5th time; J. B. Vilella, Ph. D., Associate Scientist, Full time.

SCOPE

Authorization for this program was received on December 3rd, 1963 and it is based upon work by Vilella and Gomberg while at the University of Michigan, and on similar work published by Sadun et al. Both these groups reported an acquired resistance to challenge with virulent S. mansoni cercariae after prior exposure to cercariae which had been damaged by exposure to gamma irradiation; the difference in the work of the groups lies in the route of exposure to the cercariae; while Vilella used intra-peritoneal infection, Sadun et al prefer the percutaneous route. It is the object of the present program to perfect a delicate means of assessing the degree of protection obtained and then to establish the conditions required to consistently produce maximal protection. Experiments have also been designed to test the duration of the protection conferred and the stages at which various serological tests yield positive results. When the parameters for inducing maximal protection have been established it is intended to make a detailed study of all detectable reactions which occur between the challenging parasite and the "immune" host, with special emphasis on the factors which lead to the disabling of those challenging cercariae which fail to mature. The problems attendant upon reasonably accurate quantitation of the "immune response" or degree of protection conferred upon a mouse which has been exposed to irradiated cercariae are virtually insuperable using techniques in current use by parasitologists.

STATUS

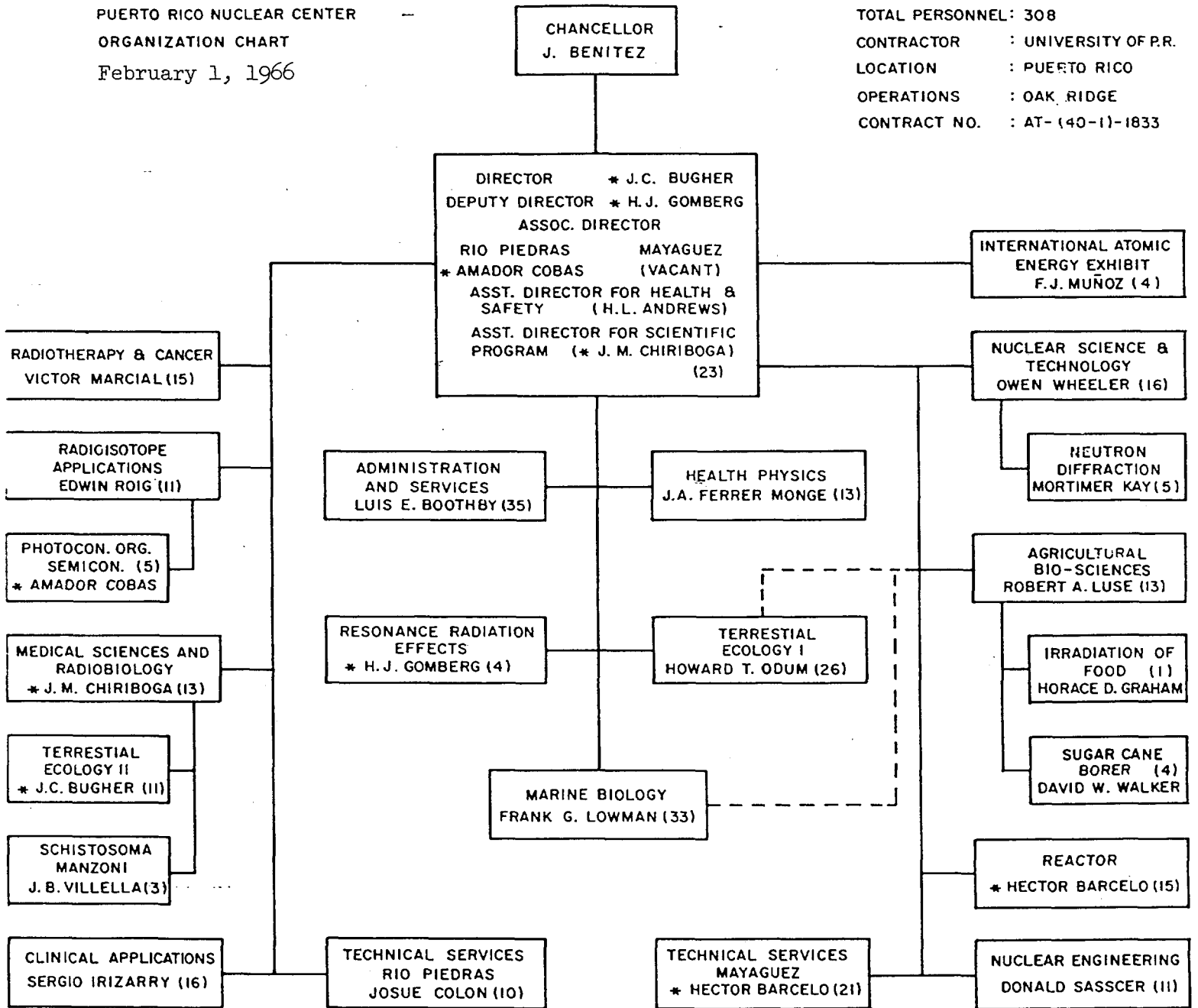
We have now perfected a method of assessing the degree of infection which is based on the number of S. mansoni ova which can be recovered from the feces of the infected mice, using standardized observation procedures. This is so sensitive that it readily shows variation in mouse susceptibility with age - most authorities have claimed that no such phenomenon exists. Experiments are currently in progress to determine the optimum amount of radiation for cercarial exposure, in order to induce the greatest degree of resistance to challenge. The results of the experiments should be hand early in 1966 after which the final phase of the program can be mounted.

3. Effect of wetting agents on foliar absorption of phosphate- Experiment begun November 1 (Meyer, Roldán).
 4. Protein synthesis in meristem tissue - C^{14} -labeled amino acid incorporation studies have established kinetics (Maretzki).
 5. Identification of tissue nucleotides - several compounds found (Maretzki).
- c. Radiation sterilization of sugarcane borer (Walker).
- d. Radiation preservation of tropical foodstuffs
1. Shelf-life extension of mangoes - Thesis study is nearly completed (Cuevas).
 2. Effect of radiation on pectins in mango - Extensive depolymerization occurred with 2 megarad dose, polygalacturanase activity was found (Deshpande).
 3. Shelf-life extension of bananas - Effects of gamma radiation on shelf-life and nutrient levels now underway (Graham).

limestone, serpentine or rocks of volcanic origin, the characteristics of variability in trace element content of populations of organisms from a given environment, and the development of methods for analyzing trace elements in a variety of sample types.

PUERTO RICO NUCLEAR CENTER
 ORGANIZATION CHART
 February 1, 1966

TOTAL PERSONNEL: 308
 CONTRACTOR : UNIVERSITY OF P.R.
 LOCATION : PUERTO RICO
 OPERATIONS : OAK RIDGE
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* DUAL FUNCTION

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