

PRNC-47 PUERTO RICO NUCLEAR CENTER GENERAL INFORMATION (Revised July 1965)  
(OPERATED BY UNIVERSITY OF PUERTO RICO UNDER CONTRACT NO. AT (40-1)-1823 FOR  
U.S. ATOMIC ENERGY COMMISSION. ---Page Break--- ---Page Break--- TABLE  
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PUERTO RICO NUCLEAR CENTER GENERAL, NARRATIVE 'The budget proposal for FY-1967  
reflects a modest increase in the FY budget commensurate with a healthy conservative  
development of the Program. It marks the beginning of a second phase for PRNC in which the  
training and research areas, having been stabilized, will seek depth and maturity. The second  
phase may be

tied to the favorable report on PRNC by the AEC 'Ad Hoc Committee which made its evaluation at  
the end of calendar 1965. Subsequent action by the Commission in accepting the committee's  
report, including the shift of supervision to the Division of Training and Education, gave assurance  
of the greater stability of PRNC necessary for sound development. Programmatic support for  
specific research projects by the Divisions of Biology and Medicine, Research, and Isotope  
Development has also shown a moderate healthy increase in keeping with the development of staff  
and facilities. As facilities improve, PRNC will be able to take on the solution of additional problems  
of direct interest to the AEC program divisions. By virtue of its location in the inland tropics, PRNC  
can offer a unique environment, particularly in the life sciences, which makes possible the solution  
of important special problems under the most favorable conditions. Particularly noteworthy in this  
regard are the programs in terrestrial and marine ecology, and their relationship to the possible use  
of nuclear explosives for the proposed Isthmus Canal. It can offer more useful support to AEC  
programs than is now being used. The new Animal Quarters Building in Rio Piedras, and  
Administration and Shop Buildings in Mayaguez will make handling of current programs more  
effective. However, there will continue to be severe crowding in the Rio Piedras building which will  
be relieved only by construction of the proposed extension of the Bio-Medical building. We urgently  
solicit support for this construction project. Important results achieved within the Divisions and  
Programs are very briefly stated in the Division and Program narratives. They are summarized in  
greater detail in the 189's and Renewal Proposals which accompany the Budget Proposal.  
Complete Progress Reports have been written for each program receiving support from the  
Divisions of Biology and Medicine and of Research. The following list includes a brief selection of  
highlights taken from the

Division and Program Reports: 2. The completion of the irradiation phase of the Terrestrial Ecology T Program, The three-month exposure in the Lugullo Experimental Forest ---Page Break--- was completed without incident and the program now enters its third phase of post-irradiation studies in the forest. 2. During the irradiation, a virus made its appearance among the bats and mosquitoes of the area. Studies leading to the identification of this virus are now in progress; this is the first discovery of an indigenous arthropod-borne virus in Puerto Rico. 3. Studies of iodine uptake by human thyroids have shown that persons of the tropically adapted population of Puerto Rico have normal values that differ from those of northern latitudes. Uptake is consistently less in Puerto Rico than in continental United States. 1. Laboratory colonization of the Sugarcane Borer, *Diatraea saccharalis*, was achieved as a necessary step in the exploration of radiation as a means of controlling this parasite. 5. The completion of a new building to house experimental animals, principally mice, and laboratories devoted to virology and cancer will permit the full activation of programs 06 and 07 in Radiobiology and Virology. 6. By incorporating bromine in the DNA of cotton root tips by feeding *Bacillus thuringiensis*, it was found that the frequency of chromosome breaks due to constant pulsed monochromatic X-rays was substantially increased at the absorption edge of bromine (13.08 KeV). This extends the earlier results with other elements in metalloenzyme systems. 7. Agricultural Bioscience: This division, which had been practically inactivated because of insufficient funds for fiscal year 1965, received the benefit of an overhead adjustment in programs 05 and 06 and was again made operative in the second half of fiscal year 1965. The increase shown for fiscal year 1966 represents the level the agricultural portion of the program must achieve if PRIC is to be effective in this vital area by fiscal year 1967. 8. Nuclear Engineering: Graduate work in nuclear

engineering has achieved a high level of activity with approximately twenty students through the year. The great interest is a reflection of the imaginative plans of the Puerto Rico Water Resources Authority for the next twenty years. ---Page Break--- PUERTO RICO NUCLEAR CENTER DIVISIONAL NARRATIVE Director's Office: The Director's Office operates at both Rio Piedras and Mayaguez as does the Administration and Services Division. Separation of programs and administrative activity results in high communication and travel costs. In both items, expenditures will be greater due to a recent increase in telephone rates granted by the FCC and the increase in local air rates. Weekly staff seminars at both Rio Piedras and Mayaguez are an established part of our scientific program. Visiting scientists and consultants are scheduled as guest lecturers whenever feasible and their contribution has added substantially to the scientific background of the staff. PRNG has been host to several scientific groups which chose to meet in Puerto Rico because of interest in the programs of the Center. It was host to the first Inter-American Power Reactor Conference sponsored by the OAS at which were discussed the generation of electricity by nuclear energy, desalting of sea water, and the construction of canals by use of nuclear explosives. At the invitation of the ABC Division of Special Projects, PRIC in collaboration with the Oak Ridge Institute of Nuclear Studies participated in the "Atomic-ate Work Exhibit" in El Salvador. Personnel are scheduled to participate in this project in other Central American countries during the next fiscal year. The Summer Institute of Radiobiology was suspended for the purpose of conducting a survey of task participants to evaluate the use being made of their training and of the equipment acquired under this program. State in the Director's office has been increased for the purpose of improving the Center's operation in relation to needs of Latin American countries and especially their

universities. It is planned to resume staff travel to Latin America to encourage institutional interrelationships. Administration and Services: Three major changes have been instituted in the

methods of rendering accounting service. First, to correct previous deficiencies, cashier services and accounting have been completely separated. There is now no overlap in work assignments. Second, accounting operations using IBM 1620 equipment of the University have been initiated. It is now possible to give the Director's Office and the Division and Program Heads prompt information on their fiscal status. Third, new personnel have been added so that the necessary services can be rendered promptly and effectively. ---Page Break--- In cooperation with the Technical Service Divisions and the Reactor Division, all service operations are charged on a monthly basis. All Divisions and Programs now pay for non-overhead services such as reactor irradiations, shop services (machine, carpenter, electronic and glass), long-distance phone calls, etc. The Administration and Services Division in Mayaguez has been operating in scattered space and under very crowded conditions. In 1965 ground dressing was requested for a new building to house all these services properly, and in turn to release space in the main building for research use. Reactor: A new Hazards Summary Report for the Swimming Pool Reactor, designated as a PRYC document and containing substantial new and revised old information, was completed and delivered to the Atomic Energy Commission. The operators and supervisor for the second shift, to begin July, 1955, have been trained and the crew for a third shift is being recruited for beginning. On acceptance of the Hazards Summary Report, amendments to cover two megawatt operation will be filed. Initial studies for five megawatt operation, foreseen for FY-1968, have been initiated. Use of the reactor for research has begun to impose steady-state load requests which leads to frequent conflict with the needs for nuclear contracting.

research and student experiments. Wherever possible, the work and ice use have been quite better in SE. "Economics of the LAT? Let not always an adequately flexible unit be used for ree ree aang and criticality experiments. We would like to see the low-power portable core in the second pool to take the low-Heese Teaching Load, a significant first step in this direction can be taken from the cognition from it, Belvoir of the complex vacuum-tube The Soeoadon console from their pool reactor. They have one £0 a ERENEGtleca system. Further planning and preparation, smelting farada studies will go on in 196. 'The major uses for the pool reactor have been in the neutron diffraction programs, which use two spectrometers occupying six-inch beam tubes, the study of radiation effects on thermal emissivity of graphite, which uses an 8 inch beam tube, the activation programs which use the poolside stations and open pool irradiations, and many special irradiations in support of research programs and thesis studies, such as fast-neutron-induced mutations in sugarcane. A borated-water shutter is being installed in a six-inch beam tube, and a temporary block-type shielded room for irradiation of small animals erected around the tube exit. 'The 1-77 reactor has had a heavy schedule as the major training unit for 'The Nuclear Engineering Division. This unit was improved with new safety circuits installed with ORO safeguard committee approval. ---Page Break--- Division training activity for 1965 included two supervisors for the Columbia, S.A, reactor and six operators for the BONUS project. Division personnel are also directing thesis problems, primarily on heat transfer, for three students in the Nuclear Engineering program. 'The increase in reactor-based activity indicates a growing need for personnel space and laboratory-type facilities within the reactor building. The necessary building volume and area is available for such development. Nuclear Science and Technology: This division is responsible for teaching and

research in nuclear energy related areas of the physical sciences. 'Through the division, support of the Master's degree' program in physics and chemistry of the University is provided. This support takes the form of the teaching of specialized graduate-level courses and provision of facilities and problems in nuclear energy areas for the required 'master's degree theses. In addition, facilities and

research support for thesis work are provided to degree candidates at the master's and doctorate level who have been drawn from the United States and from Latin America. Studies in residence under these programs receive support from the U.S.-ABC Graduate Fellowship program, the International Atomic Energy Agency, their governments, or other agencies of their home countries. The student continues his affiliation with his home university, and the degree is awarded by that university. Post-graduate training and experience for new Ph.D.s and for mature scientists seeking advanced information and techniques are also provided for U.S. citizens and for qualified men from foreign countries. In addition to the training-oriented teaching and research, the division provides the administrative framework and scientific environment for physical and chemical research at the professional level and of direct interest to the program divisions of the Atomic Energy Commission. This work is supported by the appropriate AEC division, and the work done is pertinent to the program of the division, but its presence has a very marked influence in setting the standards of quality of the work expected from students in theses and in post-graduate work. The major scientific areas of activity in the Division are solid state physics, hot-atom chemistry, neutron diffraction (reported separately), low energy neutron physics, radiation chemistry, and instrumentation. The solid state physics research lies in two major areas. The nature of the electric properties of crystals and the effect of neutron, gamma, and x-rays upon them, and the effect of

Selected energy photons on alkali-halide crystals. Three papers from the first group on the magnetic structure of  $\text{FeGbx}_{204}$ , and on dielectric properties of radiation-damaged triglycine sulfate and of Rochelle salt were presented before the American Physical Society during the past year. The work on the alkali halide crystals is in part a doctoral thesis problem for a student at Harvard University. Through irradiation of the crystal with monochromatic radiation, it has been possible to control the initial site of radiation interaction and observe the relationship between the radiation absorption and the formation of lattice vacancies. A significant relationship between them has been demonstrated. Further experimental work and theoretical analysis is in progress. The problem represents a joint effort of the Physics Department in Mayaguez, which is supplying space and the radiation source, and PRNC. The hot-atom chemistry program has been devoted to a study of the valence state of compounds as formed using various isotopes of an element. Tin and antimony compounds were subjected to neutron irradiation and the change in valence state measured as a result of the irradiation and following thermal and gamma annealing. A paper on this subject was presented before the American Nuclear Society, with a graduate student as joint author. A similar program on organic phosphorus compounds has been initiated. In instrumentation, emphasis is on radiation detection systems. The work on photomultiplier fatigue has produced a comprehensive paper in Nuclear Science and Engineering on a new semi-empirical theory of this effect and the experimental results confirming the theory. In addition, a graduate student thesis study of the statistical model used in analysis was completed. Another group in the Physics Department laboratory is developing and calibrating a high sensitivity calorimeter for absolute measurements of x-rays. During 1965, this work will be taken over by a dosimetry group in the Health Physics.

Division although much of it will be used for the M.S. there's 4m physics and in nuclear engineering, radiation chemistry research has yielded papers on such diverse topics as radiation-induced bromination of 2-3 dimethylbutane and the effects of radiation on estrone in solution. The results are in press in Radiation Research. In addition, a new effort based on radiolysis of hydrogen halides has been started. The radiolytic mechanism will be studied with a view to enhancing or at least maximizing the G value. The products represent direct sources of chemical energy produced from nuclear energy, and they will be studied further as possible fuel cell feed materials. Nuclear Engineering: In its first full year of operation, this program underwent rapid expansion. Starting with

15 students, and about 9 full student years of enrollment, it jumped to 25 students and over 20 student years with the addition of 10 engineers for the Puerto Rico Water Resources Authority. Additional teaching personnel were recruited from the Health Physics Division and from the PRWKA to help absorb the load increase. Since each student must complete a thesis before the college will grant the degree of Master of Science in Nuclear Engineering, PRIC is being hard pressed to develop about 15 suitable thesis problems. However, this has been done and the laboratory will benefit from work on many problems in instrumentation, heat transfer, reactor dynamics, dosimetry, and radiation effects. ---Page Break--- Upon graduation of the current large group, enrollment will stabilize at about 20 students and 12 student years of teaching, unless the Water Resources Authority makes another late decision to train more. A full-time state member from U.C.L.A. has been added for 1966 to improve the handling of the base program, and the Water Resources Authority has pledged help again if they add more students. The Nuclear Engineering Division of PRNG is, at this time, engaged primarily in advancing the degree program of the college with advanced training and

research support. However, in addition, research programs are being developed by the faculty in areas of direct interest to PRIC. These include studies on radiation effects on the thermal emissivity of graphite, development of a neutron energy selector based on exclusive reflection techniques, and the generation of random numbers based on short time fluctuations in decay rate of a long-lived isotope. The last is in response to the need for a random number generator for shielding calculations using Monte Carlo methods. The recent Latin American Conference of Nuclear Energy demonstrated the great interest in Latin America in nuclear power. Continued development of the FRNC program proper and cooperative work with BOMS and other atomic energy installations are needed to keep pace. Within the ASC Nuclear Science and Engineering Fellowship program, four recipients have selected the U.P.R.-PRNC program for their training, Health Physics: the primary responsibility remains surveillance of conditions to ensure health and safety of all PRC personnel. Specific activities include personnel monitoring, area monitoring, environmental surveys, waste disposal, and decontamination as needed. In addition, all aspects of industrial safety and fire prevention are now centered in the division so that it is truly concerned with all aspects of guaranteeing a safe working environment. The division personnel discharge their responsibilities through inspection, education and, where necessary, citation. The operating and research divisions are responsible for carrying out their activities in a manner without the immediate presence of health physics personnel, except in unusual cases. In addition to the operational safety responsibility, the division operates an infirmary for orderly and proper attention to injuries, and also provides the "Occupational Health Program" developed in keeping with Manual Chapter 0528. This program has been started in Mayaguez and, as soon as the difficulties unique to the local environment are resolved,

Out, it will be extended to cover Río Piedras. Experience with the program up to now, based on about 150 employees, has been excellent. To help the research groups, particularly in the life sciences, with the multifaceted difficulties of accurate radiation dose measurement, a dosimetry group has been formed within the Health Physics Division. The group will help develop techniques and set standards for dosimetry with all types of ionizing radiation.

The educational program in Health Physics has been de-emphasized while efforts were concentrated on improving the health physics service provided to the laboratory. While the improvement process is still in full swing, the addition of staff and existing progress makes possible the focusing of attention on health physics education again. Participation is continuing in the

national Health Physics Fellowship program, and four fellows, two from Puerto Rico and two from the United States, have elected to take their program at UPR-Rio Piedras.

**Agricultural Biosciences Division:** The training and education functions of the Agronomy Division continue in teaching nuclear techniques used in agricultural science (plant physiology, genetics, and agricultural biochemistry). Work is done at both the undergraduate and the graduate levels through formal coursework offerings and by thesis research leading to the M.S. degree. At present, four students are at various stages in graduate studies carried out within the Division. In addition, the staff is involved in the advanced training of an ORINS and an IAEA fellow in GRINS customer participants.

Research activities of the Division fell within three major programs: effects of ionizing radiation on plants, application of radioisotopes to crop studies, and food preservation through radiation. The first of these programs is concerned with plants that are important economically in the tropics. Emphasis has been placed on neutron activation effects as the Puerto Rico Nuclear Center is unique in having a research reactor in the tropics available for biological studies.

studies. Smeition effects are being evaluated in terms of the genetics, physiology, and biochemistry of the plant system. Specific projects include production of a high sucrose mutant of sugarcane through neutron irradiation of fe 3 Gheeriak. Biochemical mass screening of plants grown from this seed is carried out at the first and second generation through use of a non-destructive tissue sampling and subsequent chemical assay for microgram quantities of sucrose and reducing sugars. Another project is investigating the biochemical pathways of sucrose formation and degradation in sugar cane. Here, rates of protein formation in cell-free extracts of sucrose are measured by determining incorporation of C-14 labeled amino acids. Other studies are directed toward identification of nucleotides found in sugarcane. Radiotracer techniques have not yet been applied extensively to the agriculture of the humid tropics. To establish fundamental principles and relationships which may be applied to agronomic practice is the aim of this program within the Agricultural Bio-Sciences Division. At the present time, projects here deal with uptakes of strontium and calcium by plants grown in soils containing different levels of these elements. Under development are projects studying the micronutrients nutrition of sugarcane that may be influenced by agronomic and environmental factors, and the cycling of micronutrients in tropical crops. In all of this work, emphasis is placed on the application of radioisotope tracer techniques. The third area of division research is that of the preservation of tropical fruits and vegetables by ionizing radiation, with the aim of making feasible the shipment of this exotic food to commercial markets. Study of the radiation pasteurization of mangoes is being carried out, using the PRIC 2,000 curie cobalt 60 gamma source. Extension of storage life for up to thirty days at 50°F was found after 250 kilorad doses. Two being investigated are the best conditions of pre- and

post-irradiation treatment and varietal differences. Soon to be studied are the changes induced by radiation pasteurization in levels of vitamins, sugars, and pectins found in mangoes and the radiation survival of the microbial factors responsible for spoilage. Extension of these studies to bananas is likely, through the Division of Radioisotopes Development's support. The state is engaged not only in the research indicated above but also participates in the 06 program research of PREC, particularly in the 'Terrestrial Ecology 1 Program, the Paranutation Program, and the Resonance in Radiation Program. "Cooperative research with various agricultural institutions in Puerto Rico and in Central America (via the U.S.-ABC Atoms in Action Exhibit) continues. International Atomic Energy Exhibit: PRNC is participating with ORINS in the Central American

“Home-at-Work” exhibit. PRN is responsible for the operation of the gamma source and neutron source and for developing the research program in physics, chemistry, and biology in which these sources are used. The exhibit was inaugurated in San Salvador, El Salvador on February 23, 1965. Research work undertaken under the PRNC program included the uses of gamma radiation in entomology, genetics, food preservation, and dosimetry. A total of 964 samples were irradiated using the Cobalt-60 gamma irradiation facility of the exhibit; this was the largest number of samples irradiated during an AEC International Exhibit. A research program undertaken in El Salvador has a close relationship with PRIC research programs in Puerto Rico and is also related to the agriculture and the economy of El Salvador. Five PRN staff members and two technicians traveled to San Salvador during the exhibit. Detailed follow-up programs in entomology and genetics have been planned. Similar programs will be continued for the next three years that the exhibit will be in Central America. Radioisotope Applications: This Division continues to offer training in the use of radioisotopes in the physical and

biological sciences. There will be an indefinitely continuing demand for this training, especially for students of the University of Puerto Rico. The basic course is offered five times a year and it will probably not be necessary to expand it. With time, a larger proportion of students coming from Latin America will have already had the equivalent in their own universities. The expansion of graduate work in chemistry related to radiation and nuclear reactions has been well established. The research program, all of which is built around the graduate activity, is being developed under the sections: 1. Organic Chemistry a. Synthesis of compounds of interest to the nuclear field, especially medicine and radiobiology. b. Quantitative study of organic reactions utilizing radioisotopes. 2. Solid State Physics of Organic Crystals (Sponsored by ABC Division of Physical Research). This section studies the effect of neutron and of gamma and X-ray irradiation on the photoconductivity of organic crystals. Measurements have been limited to anthracene crystals; plans are being made to extend the work to other organic crystals. The indications are that the program of this Division will attract all of the graduate students for whom laboratory space can be provided. A temporary structure has been erected outside the Biomedical Building which can house eight graduate students. Clinical Radioisotope Applications: The Clinical Applications Division is offering three types of courses for education and training of physicians; maintains diagnostic services at the Puerto Rico Nuclear Center to support its teaching program; operates the Radioisotope Laboratory at the University Hospital for the Medical Staff of this Hospital; collaborates in investigative work with other institutions according to the General policies of PRNC and conducts its own research program characterized by work of clinical nature on problems of local and general interest. Radiotherapy and Cancer: The main purpose of this program is the

training SF physicians and allied personnel in all aspects of the application of nuclear energy to cancer. Another purpose is the development and carrying out of a program of research activities conducted with the purpose of improving our knowledge in the cancer and radiation fields. The following functions are carried out to accomplish these purposes: 1. Formal instruction to physicians who want to become qualified radiation therapists. This residency training lasts three years with the addition of a year of supervised practice in the specialty. 2. Formal instruction is also offered to experienced physicians in radiation therapy who have been engaged in this field for a considerable length of time, which permits them to conduct specific research projects in their field and participate in all teaching activities. 3. Training of fourth-year medical students to familiarize them with cancer and radiotherapeutic techniques. 4. In-service training for nurses, technicians, and radiological physicists. Medical Sciences and Radiobiology: The actual content of the field of radiobiology has been divided in a natural manner between Agricultural Bio-Sciences, Health

Physics, Medical Sciences, and Radiotherapy and Cancer. It can be said that radiobiology is oriented to plant science in Mayaguez and to medical science in Rio Piedras. In the latter location, the small program which previously existed in the Division of Radiobiology is being continued. 1. Tissue Culture Program: The first phase in the program was the development of a central tissue culture facility. It has been evident for some time that several divisional programs have a requirement for the employment of tissue culture techniques. It was also obvious that the size of this project would not permit the successful development of several tissue culture laboratories. The most logical solution to the problem seemed to be the establishment of a central tissue culture laboratory to serve the needs of all programs but in which the various members of the staff

might have affiliations with other divisions and be directly interested in their special problems. Beginning in FY-1964 and extending through FY-1965 several radiobiological studies were instituted with tissue culture cell lines. Chief among these are the studies of the intracellular capture of neutrons by organic compounds containing B-10. The organic chemistry section of the Radioisotope Applications Division has been preparing a series of new boron compounds which are described in the associated Form 289. IZ, Indigenous Viruses and their Radiation Induced Genetic Variability TIT, The use of gamma radiation to modify *Schistosoma mansoni* cercariae so that they induce immunity to attack instead of causing disease. The procedures outlined in the proposal 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. ---Page Break--- 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 best be pursued, the hoped-for outcome being a contribution to knowledge which may eventually help in combating the disease. Technical Services (Rio Piedras): This section has charge of building maintenance and the operation of an electronic shop for general instrumental repair. Shop services in general and engineering supervision are supplied by the Mayaguez branch. Technical Services (Mayaguez): The Division is responsible for maintenance of all buildings and general service facilities and for operation of the machine shop, carpenter shop, electronic shop, and glassblowing shop. For maintenance, a detailed schedule based on punched cards has been established and has proven to be very effective. It is being constantly reviewed to cover equipment not previously included, particularly new acquisitions. The shops provide services on a cost basis for non-maintenance tasks. The largest operation this year was

construction and installation of special partitions and equipment for the Latin American Nuclear Fission Conference. Addition of an electronics engineer has improved services available in the electronics shop. The glass shop is now being operated by personnel trained by our former scientific glassblower, who has returned to the United States. Glass shop service now provided is quite satisfactory, and a trainee from the Atomic Energy Commission Laboratory in Colombia is expected soon. No immediate changes are contemplated as a rev shop building is scheduled for construction in 1966. We expect to provide the necessary personnel for precision and vacuum quality work which the new facilities will make possible, ---Page Break --- PROGRAM 05 Resonance in Radiation Effects: The studies on radiation effects produced as a function of wave-length have been extended to cover genetic damage, in addition to the continuation of studies on inactivation of enzymes. A three-fold increase in chromosome breaks has been demonstrated in onion root tips labeled with BUDR, when irradiated first below and then above the K absorption edge of bromine. Work on carboxypeptidase with various metal labels is continuing, and studies on *B. coli* have been initiated. It appears that the total radiation effect depends on the site of initial absorption of the photon, for systems in which selected heavy atoms are incorporated into an otherwise light atom structure. In support of the biological studies, development of new



high-intensity low-photon-energy sources, using field excision techniques were initiated. Also, we have started study of photon focusing systems in the low energy range using total reflection techniques. To improve dosimetry, development of a high sensitivity calorimeter has also begun, in collaboration with the Health Physics Division. This program operates in close collaboration with similar studies on radiation effects in alkali halide crystals, a part of a physics program within the division of the U.P.R. Mayaguez Physics Marine Biology:

This program, started in 1962, is designed to provide information on the distribution and movement of trace elements in selected but coupled ecological and biogeochemical systems. It includes detailed studies of the marine biosphere and hydrosphere as well as limited studies of the lithosphere. Studies are made on land, on the sea, and in the sea. The geographic area under investigation centers on the west coast of Puerto Rico, with particular emphasis on the area surrounding the site of the BOMUS project, but extending for marine observations along the north and south coasts and to the eastern extremity of the island. Three rivers drain into the Nova Passage, marking the west coast of Puerto Rico: the Culebrinas north of Rincón, the Añasco, south of Rincón, and the Guanajibo south of Mayagüez. Each drains a watershed with a different type of soil system, permitting comparison in a small geographic area of significantly different trace element distributions on and offshore. Greatest effort up to now has been in the Añasco River valley outflow area, with the others developing rapidly. A complete spectrum of physical techniques has been brought to bear on these problems including tracing of natural and fallout radioactive elements, and stable element studies using neutron activation analysis, stoichiometric absorption and flame spectrophotometry, calorimetric and fluorometric analysis, x-ray emission analysis and structural analysis using x-ray and neutron techniques. Recent acquisitions of mass spectrometers will open this area, particularly for isotope ratio studies. Analyses are applied to inorganic materials on land and from the bottom of the sea and to samples taken at all points in the food web. This program has particular significance in the present period of developing use of nuclear energy. It is vital to our knowledge of the fate of radioactive materials from tests, nuclear plant outflow, accidental discharge, waste disposal and the proposed large scale use of nuclear explosives.

for earth moving. Paramutation: Genetics regulatory systems which control gene mutation have been investigated with emphasis given to the paramutation system as it occurs in maize. Radiation treatments of the components of the system have indicated that the type of change which occurs is an inactivation process rather than a true mutational event. Radio-sensitivity curves of the regulator responsible for paramutation change have been obtained. Additional sources of paramutation induction from South American sources have been evaluated and found to be generally associated with variegated aleurone types. A final report on this project, which will terminate in June 1965, is being prepared. Induced Sterility for Population Control of the Sugarcane Borer in Puerto Rico: Gamma-induced sterility effects, artificial culturing methods, and behavior have been studied to determine the suitability of the method of sterile male population over-flooding for controlling or eradicating *Distesia saccharalis* (Fab.) (Crambidae, Lepidoptera). Dosage-effect studies have shown that adult males can be effectively sterilized at 18 kilorads, and at 14 kilorads in virgin adult females. Adult longevity and oviposition are not affected by radiation below 70 kilorads. Mortality dose for larvae is between 2 and 11 kilorads, and development is abnormal at dosages needed to produce sterility. Pupal development is adversely affected by dosages of 8 to 12 kilorads without induction of sterility. The artificial culturing methods developed are adequate for present needs and mass-rearing methods are under investigation. Terrestrial Biome, Volume I: Radioecology of a Tropical Rain Forest: The rain forest irradiation project was started in the Spring of 1963, with the objectives of determining the effects of gamma irradiation on the montane rain forest near El

Yunque and the movement of chemical elements of fallout in the normal biogeochemical cycles. An area in the Luquillo Forest Reserve provided by the U.S. Forestry Service has been developed.

with trails, towers, instrumentation, electric power, and work facilities, A group of 12 participating investigators from ---Page Break--- other universities began a year of measurements preceding irradiation. The project now involves 65 phases with 15 resident scientists and student assistants. The effect of irradiation will be assayed by measurement of animal noises, vegetation density to light, plant and animal populations, changes in microclimate, localized effects, cytogenetic effects, and changes in chemistry and fallout. A 10,000 curie Cesium 137 source was installed on January 19, 1965, and the irradiation was completed April 27, 1955; study of the effects produced by the irradiation began on this date. Fallout elements are traceable with existing levels of activity and with tracer experiments. The level of fallout held in the vegetation is relatively high, indicating the effect nutrient holding ability of the vegetation. Terrestrial Ecology Program II: Radiation Induced Variability work on the regular study area was continued with successful mosquito and rat trapping and bleeding taking place at regular intervals. It is hoped to have a clear picture of the arboviruses present in El Verde before the radiation source is added. No viruses have as yet been encountered in the El Verde material. The Mechanics of and the Inoculation of Mice with Irradiated and Normal *Schistosoma mansoni* Cercariae: Approval for this program was received in December, 1963, and the first preliminary experiment designed to determine the number of sexually paired cercariae necessary to induce a standard infection is underway. A modest mouse colony is available and cultivation of host snails for the program has also been started. Previous work indicated an acquired resistance to challenge with virulent *Schistosoma mansoni* cercariae after infection by cercariae which had been damaged by exposure to gamma irradiation. When the optimal experimental procedures have been established, it is intended to make a detailed

study of all detectable reactions occurring between the challenging parasite and the "immune" host. ---Page Break--- 'PROGRAM 03 Neutron Diffraction Program: The Neutron Diffraction Program has undertaken work on magnetic ordering and on the determination of light atoms in the presence of heavy atoms; the two fields in which the neutron technique has provided unique contributions to solid-state physics and chemistry. Magnetic work has been undertaken with the cooperation of Brookhaven National Laboratory personnel. The structure of  $\text{FeGaSiO}_3$  has been solved and Paging and  $\text{CuCrO}_4$  are under investigation. The structure of  $\text{CaY}_2\text{O}_4$  (a laser matrix) has been determined as part of the program of determining the positions of light atoms in the presence of heavy atoms. Under investigation are d-tartaric acid and its hydrogen bonding and Cu Formate which becomes antiferromagnetic at  $17^\circ$ . Preliminary diffraction results indicate disordered hydrogens, and dielectric constant measurements indicate a hitherto undiscovered phase transition at GBC which may be associated with the disorder. Work will continue on deuterated material and other hydrates with interesting physical properties. In addition to the PRNC personnel and Brookhaven employees that initiated the project and have continued to cooperate with it, Dr. K. Okada, a solid-state physicist from Nagoya Institute of Technology, Japan, is completing a two-year stay; Dr. I. Bielen, a German government scientist, spent two years here; and Dr. D. J. Croner of Los Alamos Scientific Laboratory is spending a year at PRIC to work on alum structures. Studies in Organic Crystals using Electrical Conductivity: Effects of neutron, gamma, and x-ray irradiation on the electrical conductivity of anthracene crystals are under study. Initial phases of the study have been limited to changes in dark and photoconductivity produced by neutron, gamma, and x-ray irradiation which apparently knocks out hydrogen atoms from the crystal. Electrical conductivity was selected because evidence

indicates this parameter is most sensitive to the presence of impurities or defects. Another phase of this investigation will include a more precise and direct technique for determining trap densities and depths by measuring mobility and conductivity as a function of temperature. ---Page Break---  
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Congress of Chemistry September, 1962 Buenos Aires, Argentina 'The Johns Hopkins University- April, 1962 Baltimore, Maryland American Society of Agricultural Sciences October, 1962 Mayaguez, Puerto Rico ---Page Break--- Dr. Howard J. Teas Dr. José M. Tone Dr. Jaime Usifas Dr. John Vilella # SoA. Wethington Dr. Temsel Almodévar Write Keto Acids in Some Tropical Plants Inhibition of Banana Fruit Ripening by Gamma Radiation Hodgkin's Disease: Our Experience at the Dr. I. Gonzalez Martinez Oncologic Hospital Carcinoma of the Tonsil Immune Responses to Transmitted Cercariae of Schistosoma Mansoni Dosimetry from Photon Spectra and Pulse-Height Distributions 1963 A Neutron Diffraction Refinement of the Ca WO), Structure Method for the Isolation of Thorium from Siliceous Materials New Results in the Search for Alpha Particles from the Thermal Neutron-Induced V238 (a, @) U235 Reaction Place Presented 'Annual Meeting of the Society for Economic Botany- June, 1962 Washington, D.C. 2nd. International Congress of Radiation

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Society May, 1963 Milwaukee, Wisconsin 5th International Congress of Genetics September, 1963 Scheveningen, The Netherlands Fall Meeting of the American Society of Agricultural Sciences October, 1963 Mayaguez, Puerto Rico 2nd Caribbean Chemical Symposium - Aug. 1963 in Piedras and Mayaguez, Puerto Rico 5th Annual Meeting of the Radiation Research Society May, 1963 Milwaukee, Wisconsin 2nd Caribbean Chemical Symposium Aug., 1963, in Piedras and Mayaguez, Puerto Rico Conference on Basic Mechanisms in the Radiation Chemistry of Aqueous Media May, 1963 Gatlinburg, Tennessee ---Page Break--- Author Dr. Victor Marcial Dr. Victor Marcia Dr. José M. Tomé Dr. P.J. Matoz Miss Milagros Mixé Dr. Badie Ortiz Dr. Juan Facetts Dr. H. Harry Semant Mr. E.P. Olavaresa Dr. H. Harry Scmant Dr. Ravin Roig Mr. Raúl H. Figueroa Dr. David Walker Mrs. Adela Alenaty Dr. David Walker Late cancer of the Lens Radiotherapy in Carcinoma of the Cervix

Effect of Copper Sulfate on the Ceric Dosimetry Byeten High Energy Gamma Photons - Neutron Conversion Device for Half-Life Measurements Base-catalyzed Formation of Indicator Association Constants for Sulfexide-Phenol Complexes Longevity of Adult *Diatraea saccharalis* (Fab.) Crambinae, Pyralididae, Lepidoptera Mating Behavior and Fecundity *Diatraea* Mating Behavior of the Sugar-Cane Borer, *Diatraea saccharalis* (Fab.) Crambinae, Pyralididae, Lepidoptera Place Presented at Congress of the Pan Pacific Surgical Association November, 1963 Honolulu, Hawaii Annual Meeting of the Waters Branch of the Real Association April, 1963 Mayaguez, Puerto Rico 2nd Caribbean Chemical Symposium August, 1963 Rio Piedras and Mayaguez, Puerto Rico American Physical Society January, 1963, New York and Caribbean Chemical Symposium - August, 1963 Rio Piedras and Mayaguez, Puerto Rico 2nd Caribbean Chemical Symposium - August, 1963 Rio Piedras and Mayaguez, Puerto Rico Fall Meeting of the American Society of Agricultural Sciences October, 1963 Mayaguez, Puerto Rico Entomological Society of America Meeting December, 1953, St. Louis, Missouri Fall Meeting of the American Society of Agricultural Sciences October, 1963 Mayaguez, Puerto Rico ---Page Break--- Author Dr. David Walker Mel Wigue2 Figueroa Dr. M. P. Woodburn Dr. Owen H. Wheeler Mrs. G. de Rodriguez Dr. Owen H. Wheeler Mr. D. Gonzalez Rev. I. Cantarell, Dr. Eadie Ortiz Mr. Heriberto Plaza Rev. I. Cantarell Hey. I. Cantarell Rev. J. Cantarell Dr. Juan Facotti Miss Eloisa Trabel Mr. Ricardo Vega Oviposition by *Diatraea saccharalis* (Fab.) Crambinae, Pyralididae, Lepidoptera Rift Valley Fever and Nairobi Sheep Disease Acid-catalyzed Solvolysis of Some Substituted  $\gamma$ -Butyrolactones and  $\gamma$ -Valerolactones Oxidation of Primary Aromatic Amines with Manganese Dioxide 1964 Experimental Demonstration of Neutron Albedo in Water A. General Time Effect of the Sentory Type Excitons and Color Centers in MgO Neutron Radiation Effects on Solid State Detectors Place Presented Fall Meeting of the American

Society of 'Agricultural Sciences October, 1963 Mayaguez, Puerto Rico 'ea, International Cong. of Tropical Medicine and Malaria September, 1963 Bio de Janerio, brags end. Caribbean Chemical Symposium- August, 1963 Rio Piedras and Yauco, Puerto Rico 2nd Caribbean Chemical Symposium August, 1963 Rio Piedras and Mayaguez, Puerto Rico YOKIIT Annual Meeting of the American Association of Physics Teachers January 20-25, 1964 New York City Latin American Conference on Nuclear Spectroscopy and Solid State Physics February 24-27, 1964 Lima, Peru Latin American Conference on Nuclear Spectroscopy and Solid State Physics February 24-27, 1964 Lima, Peru Latin American Conference on Nuclear Spectroscopy and Solid State Physics February 24-27, 1964 Lima, Peru ---Page Break--- Author Rev. I. Cantarel Rev. José M. Brussi Dr. Julio A. Gonzalo Dr. Juan F. Facetti Miss Blofsa Trabsl Mr. Sigfredo Torres Rev. I. Cantarell, Rev. I. Cantarell Dr. Juan F. Facetti Dr. Frank G. Lowman Dr. Robert Stevenson Dr. H. Harry Szmant Miss Juan J. Rigas The Variation of the Internal Field Produced by Gamma Irradiation in Triglycine

Sulfate Crystals by an Average Field Distribution of svl25 Formed in Tin Compounds by Neutron Capture Properties, Mechanism and Experimental Reduction of Effects of the Time Dependent Field Emission of Photomultiplier Tubes (ave-32) Reduction of Fatigue Effects in Photomultiplier Nb 'Trace Analysis in Water from Lake Ypacaral Investigations in Trace Element Distribution in Marine Water and Sediments Stable Element Analysis of Some Marine Organisms 'The Structure of Four Isomeric 2-Phenyl~ sulfynylindenols Place at Latin American Conference on Nuclear Spectroscopy and Solid State Physics February 21-27, 1964 Lima, Peru Latin American Conference on Nuclear Spectroscopy and Solid State Physics February 21-27, 1964 Lima, Peru Ninth Scintillation and Semiconductor Counter Symposium February 26-28, 1964 Washington, D.C. Ninth Scintillation and Semiconductor Counter Symposium February 26-28, 1964 Washington, D.C. Inter-American Symposium on

the Peaceful Application of Nuclear Energy March 9-13, 1964 Valparaiso, Chile Inter-American Symposium on the Peaceful Application of Nuclear Energy March 9-13, 1964 Valparaiso, Chile Inter-American Symposium on the Peaceful Application of Nuclear Energy March 9-13, 1964 Valparaiso, Chile Symposium dealing with "Organic Sulfur Compounds," Meeting of the American Chemical Society April 6-10, 1964 Philadelphia, Pa. ---Page Break--- Author Dr. Agustín Cajigas Dr. H. Harry Semant Dr. Julio A. Gonzalo Dr. Malcolm Dantels Dr. Mortimer Key Dr. A.S. Andresen Dr. Peter Fischer Dr. Mortimer Kay Dr. R.A. Young Dr. R. Goodman Mortimer Kay A. Young Dr. A.B. Posner Dr. Prof. K. Soderstrom Prof. R.B. Knight Viral Studies Conducted in the Laboratories of the PRIC by a Combined Team from PRNC, the Puerto Rico Dept. of Health, and the U.S. Public Health Service, Communicable Disease Center, Atlanta, Georgia Informe sobre la Situación Actual de las Revistas Científicas y Técnicas Latinoamericanas: Química Polar Anisotropy Centers in Gamma-Radiation Triglycine Sulfate Photoreactions of Some DNA Bases A Neutron Diffraction Study of CaN and CaN Goniostate for Siemens and Philips Diffractometer X-Ray and Neutron Refinement of Hydroxyapatite PREC Engineering and Related Activities Face Presented British Ninth Scientific Meeting- April 13, 1964 Kingston, Jamaica UNESCO Meeting - Centro de Cooperación Científica de la América Latina University of Puerto Rico April 28 - May 2, 1964 Piedras, Puerto Rico American Physical Society Meeting- April 30, 1964 Washington, D.C. International Photobiology Congress July 25-30, 1964 Oxford, England American Crystallographic Association Meeting July 26-31, 1964 Bozeman, Montana American Crystallographic Association Meeting July 26-31, 1964 Bozeman, Montana American Crystallographic Association Meeting July 26-31, 1964 Bozeman, Montana Eighth Convention of the Pan American Union of Engineering Associations (URAD) August 17-21, 1964 Caracas, Venezuela ---Page Break--- Author Dr. Aldo By Lanaro Dr. Sergio

Irizarry Dr. Mario Tturalde De. Manuel Pantagua Migs Zonaida Prius Dr. Antonio Bosch Dr. Antonio Bosch De. Víctor Marcial Dr. Víctor Marcial De. Víctor Marcial Dr. Víctor Marcial Dr. José M. Toms Dr. Jeanne Ubidías mate Evaluation of the Renal Condition in Diabetics Using Radioactive Isotopes Cancer of the Anterior 2/3 of the Tongue Management of Cancer of the Uterine Cervix Associated with Pregnancy Irradiación Pre-operatoria Radioterapia Convencional y Supervoltaje Significance of the Presence of Exfoliated Tumor Cells in Cases with Carcinoma of the Uterine Cervix after Radiation Therapy The Radiologist & Cancer Center Activities in a Community Cancer of the Nasopharynx Cancer of the Tonsil of Mucosal Biology and Medicine - Sept. 21-25, 1964 Paxio, Earl Sta, Inter-American Congress of Radiology October 2-9, 1964 Caracas, Venezuela 5th, Inter-American Congress of Radiology October 2-9, 1964 Caracas, Venezuela 6th, Inter-American Congress of Radiology October 2-9, 1964 Caracas, Venezuela 7th, Inter-American Congress of Radiology October 2-9, 1964 Caracas, Venezuela 8th, Inter-American

Congress of Radiology October 2-9, 1964 Caracas, Venezuela 9th, Inter-American Congress of Radiology October 2-9, 1964 Caracas, Venezuela ---Page Break--- Author Dr. Jeanne Ubidiás Mr. José Cuevas Ruse Dr. Duane B. Linden Dr. Víctor Marcial Dr. Aldo B. Lanaro Dr. Sergio Irizarry Dr. David Walker Ms. Adela Alenaty Mr. Miguel Figueroa Dr. Juan Pacetti Ms. Blosie Trabal Mr. Sigfredo Torres Dr. Víctor Marcial Title Place Presented Prognosis in Adenocarcinoma of the Uterine Cervix 5th, Inter-American Congress of Radiology October 2-9, 1964 Caracas, Venezuela Agricultural Applications Caribbean Food Crops of the PRIC Cobalt-60 Gamma Society Meeting Irradiation Facility October 18-24, 1964 Bridgetown, Barbados Extending Shelf Life of Caribbean Food Crops Mangoes with Irradiation Society Meeting

October 18-24, 2964 Bridgetown, Barbados Significance of the Presence of Exfoliated Tumor Cells in the Vaginal Smear in Patients Treated with Radiation for Carcinoma of the Uterine Cervix November 12, 1964 San Juan, Puerto Rico Significance of Scintigraphic, Clinical, and Pathologic Studies of Myroid Nodules November 19-21, 1964 Mendoza, Argentina Induced Sterility of *Dintrea saccharalis* (Fab.) by Gamma Radiation American Entomological Society Nov. 30 - Dec. 3, 1964 Philadelphia, Pa. Thermal Annealing of Neutron Irradiated Antimony Compounds Annual Winter Meeting of the Amer. Nuclear Society Nov. 30 - Dec. 1, 1964 San Francisco, Cal. Cancer of the Mouth and Pharynx, Diagnostic and Treatment Problems Division of Oral Health of the Commonwealth of P.R. Dept. of Health December 9, 1964 San Juan, Puerto Rico ---Page Break--- ---Page Break--- Tow. 6 22 3 10 PRNC Weekly Seminars Division Dr. José A. Ferrer-Monge Head, Health Dr. Roberto Ayala Associate Scientist Agricultural Bi-Sciences Division Dr. Mater Cota: Associate Director Dr. Courade F. Asenjo Dept. of Blocker! Sty and Health of WPA. Carlos Garcia Beato Dept. of Biology, U.P.R. Dr. Herminio M. Braz Badtateotoprs Division Nuclear Science & Technology Division Dr. Tomaei Als: Head, Science & Technology Division - Rio Piedras "Use of Probability Considerations in Experimental Biology DNA Cones and Foundationing Metallic and Clinical Significance of Changes on Leaves and their Use in Dosimetry Bacterial Inactivation by Ultraviolet Radiation Focal Statistics on the Increase of Sites for Chromosome Exchange Formation Applied Research in Alcohol Technology Multi-channel Pulse Height Analyzer Tritium Labeling of Organic Compounds ---Page Break--- Jan. Feb. yw ah 6 » 3 Mr. Alfonso Ries Mr. Julián Roa Agricultural Experiment Station, Río Piedras and Capt. Charles R. Angel U.S. Army Tropical Research

Medical Laboratory Dr. Leopoldo 8. Cerecedo School of Medicine, U.P.R. Dr. Biwin Roig Head, Radioisotopes Application Division Dr. Victor Marcial Head, Radiotherapy and Cancer Division Dr. J. As Bonnet Agricultural Experiment Station, Río Piedras Dr. Juan D. Curet, Dean, Faculty of Natural Sciences, U.P.R. Dr. W. Van Setver Dept. of Physics College of Natural Sciences U.P.R. Dr. J. Oliver González School of Medicine, U.P.R. Dr. Rail Marcial Dept. of Pathology School of Medicine, U.P.R. Dr. L. del Rosario Dept. of Physics College of Natural Sciences U.P.R. Dr. R. García Palmieri School of Medicine, U.P.R. TUTE of Tecture Radioactive Iron 39 in Tropical Crops Biological Dosimetry Tumor-host relationship studied in vivo and in vitro Kinetics of the T (1)-(112) Exchange in Perchlorate Media Exfoliative Cytology in the Evaluation of Radiation Response of Cancer of the Cervix Uteri Recent Investigations on the Maturity of Sugar Cane in Puerto Rico The Concept Temperature Physics of Radiation Detection and Measurements Serological Diagnosis of Bilharziosis Irradiation Injuries to Elastic Arteries the Van de Graaff Generator and its Applications Coronary Artery Disease ---Page Break--- base March 2 April 6 Sune a a B 2 % ESE Wise M. Palacine Radiotherapy and Cancer Invasion Dr. J. L. Daniela de Guew. Associate Director Dr. Gustave Sandrine School of Biology, UFL Fe nto Biology Department, U.P.R. Dr. L. Haddcee Dept. of Medicine School of Medicine, U.P.R. Dr. O. Rucfrez Terres Dept. of Surgery, U.P.R. Dr. A. Penal



Dept. of Microbiology School of Medicine, U.P.R. Division Dr. #. Be Samans Radioisotopes Application Division Dr. Leo Lethroun College of Pharmacy Dr. Panén Radioisotopes Application Division Dr. P. Ranos Norais School of Medicine, U.P.R. Dr. José Taner Dept. of Health of F. B. Ere seme Fhospnsve Clase Dosimeters Theory and Application PRIS 1 Megawatts Research Reactor Mechanisms involved in the association of the cells of sponges Bacterial Viruses Experimental Studies in Mistoplacnorie Mode of Activation

of Thyroid Hormones and the Adequacy of the Present Long Form Periodic "bart Radio Protective and Radio Sensitizing Agents Cyanogen with Grignard Reagent Determination of Maximum Permissible Exposure The Meaning of the Bilharzia Infestation Demographic Changes in Puerto Rico and Their Implications in the Socio-economic Development of the Commonwealth ---Page Break--- Date July Sept. 8 20 10 with a aL LECTURER Dr. Ricardo Méndez Bryan Dept. of Medicine School of Medicine, U.P.R. Dr. R. Santini School of Medicine, U.P.R. Dr. José del Castillo Dept. of Pharmacology School of Medicine, U.P.R. Dr. Duane Linden Agricultural Bio-Sciences Division Dr. Maurice P. Weinbren Head, Medical Sciences & Radiobiology Division Dr. Frank Lovan Marine Biology Program Ms. B. del Campo Radiotherapy & Cancer Div. Dr. Oven Waeelor Nuclear Science & Technology Division Dr. Barbara Weinbren Clinical Applications Div. Mr. Bector Barceló Head, Reactor Division Dr. R. Levins Dept. of Biology Faculty of Natural Sciences UPR. Dr. Peal Weinbren Head, Medical Sciences & Radiobiology Division Dr. José Maldonado School of Medicine, U.P.R. Dr. J. Heatwole Biology Dept., Faculty of Natural Sciences, U.P.R. Title of Lecture: 'Towards a Geography in Rheumatoid Arthritis Precursors of the Folic Acid Active Factors of Blood Impulse Transmission across the Nerve-muscle Junction Parametrization Quantitative Aspects of Single-Cycle Virus Replication in an Intact Animal Cycling of Elements in the Sea Fluctuations in Sex Chromatin during the Menstrual Cycle Kinetic Isotope Effect Study of the Serum Protein of Hippopotamus Linnaeus, Core-Phrygian Studies of PRIC Swimming Pool Reactor Optimum Genetic Systems Discussion of Arthropod-borne Viruses Biological Studies on Schistosoma Mansonii Detection of Hosts and Mates by Megarhyssa, a genus of parasitic insects ---Page Break--- Date Oct. Jan. 4 R Dr. Yaicoln Damels Radioisotopes Division Dr. Evelina Cruz Biology Dept. Natural Ms. M. M. Palacios Radiotherapy & Cancer Div. Mrs. Graciela Candelas Dept. of Biology,

UPLB Dr. tt dasry Semant Radioisotopes Division Dr. Robert Lise Agricultural Bio-Sciences Division Dr. Job ç, tugher Directors Mr. Fy Sanchez Sieve Agricultural Experiment Station, U.P.R. Dr. Victor Marctal Head, Radiotherapy & Cancer Division Dr. ç. Garcfe Benfver Dept. of Biology, Faculty of Natural Sciences, U.P.R. Dr. Andrew Maretokt Agricultural Bio-Sciences Division Dr. Marcelo Bertnolas Clinical Applications Division Dr. B. Toro Guyco Radioisotopes Service Veterans Administration Hospital, San Juan 1963 23 OF LECTURE Publication Chemistry of Aqueous Solution, a Survey Figments in Lizards Analog Dosimetry 203 Fixation in Marine Invertebrates Modern Concepts of Organic Chemistry Sucrose in Saga Dilution ne by Isotope Intracellular Atomic Nuclear Events and Lethality The Polarographic Determination of Dissolved Oxygen in Tectars Cancer of the Penis 209 Effect on Chromosome Aberrations Aspects of Ascorbic Acid Metabolism in Acerola Potentialities of Autoradiography in Medical Research in Puerto Rico The Uptake of Radioactive Triiodothyronine by erythrocytes: uses and Limitations ---Page Break--- Dax Jan. 18 25 Pees 1 % Maren 1 » April 5 » Feb. Ori) abva Radiotherapy & Cancer Div. Dr. John A. % Beactor 3 ehingtea sont Dr. Andrew Maretors, Agricultural vselon® Dr. J. A. Simcre Professor of Chemistry University of Florida Dr. Marcelo Bertnolas Clinical Applications Div. Dr. Dulic V. Rivera Radioisotopes Service Veterans Administration Hospital, San Juan Dr. Sergio Irizarry Head, Clinical Applications Division Dr. Antonio Bosch Radiotherapy & Cancer Div. Mrs. Graciela

Cantelas Dept. of Biology, U.P.R. Dr. A. Grinson Chemistry Dept. UPR. Dr. H.C. Goabere Department Director Miss Zenia Frfas Radiotherapy and Cancer Division Dr. J. Vy Koarollear Director Emeritus 'Metta Cancer Research Institute, Bombay, India Dr. Bawin Rots Hosa, Radioisotopes Div. TIE OF CWE weak Parensngnctisn of Inorganic Belts of the Type Kyx0), Radiobiology of the Eye Resimetry from Photon Spectra and Pulse-Heien Distribution Aspects of

Ascorbic Acid Metabolites in Acerola Space, Time and Energy Potentialities of Autoradiography in Neades Research in Puerto Rico Triolein Absorption Introduction to Human Gamma-Radiography Nephritis Post-radiation 002 Fixation in Marine Invertebrates The Photochemistry of Tamine Solutions Investigation of Resonance in Radiation Effects Statistics in a Nutshell, Concern Research in India and Chalmers Reactions in Solids ---Page Break--- PATE May 2, 2023 LETTER Dr. José M. Tone Radiotherapy & Cancer Liv. Dr. Aas Cote: Mrs. M.M. Palacio de Lozano Radiotherapy & Cancer Div.\* = Semantic Application Division= Dr. Richard Bet Plant Physiology Institute University of Vienna, Austria < Gifford of Comparative Physiology, Alfred University New York Dr. Victor Merstal Head, Radiotherapy and Cancer Division\* Dr. Fax Woinbeen Hoag, Head 'Sciences and Radiobiology Pavilion® Dr. B. F. Tyree Professor of Chemistry University of North Carolina Miss He1ai Patén Health Physics Division+ Mr. Glenn Rowin Technical Representative Coulter Electronics 6% Florida Dr. Eugene Otun Department of Biology University of Georgia Dr. Robert Iuse Agricultural Mo-Sciences Division Miss Vicky Meyers Radioisotopes Division TE2URE Hodgkin's Disease Electrical Conductivity in Organic Solids Hadlotherspy Analog Dosimetry Organic Chemistry Research in the Radioisotopes The Effects of Ionizing Radiation Regulation of Black Concentration of the Land Crab, Cantogcna Cancer of the Esophagus in Puerto Rico Techniques Used in Arbovirology The Problem of Valence State Ionization Energies Conductors as Radiation Detectors Theory and Application of the High Speed Acoustic Suspended Particle Counter and Size Analyzer Some Aspects of Radiation Ecology Beam Slicing Monochromator X-rays Fetal Lo-enzymes Photochemistry of the Ally? Radicals ---Page Break--- B 8 2 University of Georgia Nise Margaret Mkte Medical Sciences and Radiobiology Division Dr. A. 2, Dramnend Chief, Research Division Eppley Sc. Fesper\*, Radiotelsna Dr. Jeannie Ubifas Radiotherapy & Cancer

Div. Dr. Efrain Navarre Radiotherapy 3 saucer Tv. 4 be, Dr. Oliver Gonzilex Dept. 9° Far: nol of Medi Dr. Waidenar Adan Professor of Chemistry, U.P. Mr. Manuel Velez Professor, Dept. of Biology, Dr. E. Tanaro Clinical Applications Div. Dr. Max Wisser Professor of Philosophy, U.P.B. Mr. Jost B. Goyco Dept. of Psychology School of Medicine, P.R. Dr. J. Z. Ovington Head, Woodland Section Nature Conservancy in Great Britain Dr. Andrew Mareti Agricultural Bio-Sciences Division, SUSIE of Gesture Food Ecology of the Wood Stock in Florida A Study of Behavioral and Physiological Adaptations to Seasonal Drought Please Pneumonia Like Organisms and their Control Philosophy of Phonetronics Varcinoma of the Tonsil Varcinomas of the Lung Biological Functions of Antigenic Substances from Parasites Spin Resonance in Aromatic Hydrocarbons Some Aspects of the Geographic Distribution of Diplopoda in Puerto Rico Myroid Function in the Republic of Argentina The Philosophy of Science Biological Evaluation of the Important Legumes in Puerto Rico Mineral Cycles in Woodlands Regulatory Mechanisms in Metapolis ---Page Break--- van. 10 ah 2 a a March 6 3 Radioisotopes Division Dr. Ame Soliverger Dept. of Pharmacology School of Medicine, P.R. Mr. Clayton cist Research Assistant University of California Tr. Diego Roca Franceschi Ayes Lio Mario Hospital Rfo Fiedrac, P. Dr. Simon Friea Brookhaven National Laboratory Dr. Juan D. Curet Dean of Natural Sciences UPR, Dr. José Joaquin Figueroa School of Medicine, U.P.R, Dr. Cemmén Malnret Chief, Dept. of Medicine Oncological Hospital of P.R. Dr. Waldemar Aden Professor of Chemistry, U.P.R. Dr. Sergio Irizarry Head, Clinical Applications

Division. Hosa Santana de Tiredo Dept. of Chemistry, U.P.R. Ms. Graciels Sandelas Professor of Biology, U.S.P.R. Dr. H. Many Szmant Radioisotopes Division or Molecular Basis of Photobiological Effects of 2537A Radiation Statistical Problems in Biological Rhythms Research. Nuclear Test and Business, Vertigo and Syncope Resolution of States and

Beactivities in Chemistry and Biochemistry at Low Temperature the Quintic Theory of Molecular Structure Tumor of the Upper Urinary Tract Hypertension Electron Spin Resonance: Electron Transfer Reactions Effects of Radiation on Intestinal Absorption in Mammals The Effects of Beta Radiation: on Certain Inorganic Salts Biochemistry of Amphibian Metamorphosis: Study and Local Focus Research in Sulfur Compounds ---Page Break--- DATE April 3 Same day 10 a as 22 10 Head, Terrestrial Ecology Program: Part Br. Antonio Fosk Radiotherapy & Cancer Div. Dr. Luis P. Ys Head, Dept: Illo Be. Mansel Carota Morin Aa Honore Dr. Owen #. Wheeler Head, Nuclear Science and Technology Division\* Miss Zenana Prince Radiotherapy & Cancer Div. Dr. José M. Teo Radiotherapy & Cancer Div. Dr. Kusler Cotas Associates Director Dr. Alex Grinson Radioisotopes Division\* Miss Hela! Pabin Health Physics Division Mrs. M.M. Palacios de Lozano Radiotherapy & Cancer Div.\* Dept. of Ob: Gynecology, U.P.R. School of Medicine Dr. Joby B. Vitielia 1 Sciences and xy Division\* Dr. José E. Meaina Radiologist, University Hospital in Mio Piedras Dr. Helme 3. Breten Neutron Diffraction Programt SORE oP ow areutte of the Biosystem Cervix-Uterine Carcinomas and Pregnancy "Tumors ae Mediastinum" Hot Atom Chemistry of Organic Compounds Pitfalls in Medical Statistics "Summer de Wile" Fundamentals of Solid State Physics Excited States The Dosimetric Applications of Chemiluminescence Research Progress in LiF Dosimetry Present Trends in Obstetrics Immunity to Parasitic Worms (Helminthes) Mammography Investigations with X-rays and Thermal Neutrons ---Page Break--- 2 2 7 Uh Lt, cet. Mienaet P. Da tore DS. amy trapt-al Research Medical Laboratory AL Dr. Searles Dorman Professor of Biology University of West Virginia 2B Dr. Alec 'Camatscn Aa Honorex" 4 Dr. Thomas Fostesen Assistant Professor of Biology University of Puerto Rico Dr. Rail Marcial, Head Dept of Pathology School of Medicine, UFR. Dr. Victor A. Marcin Head, Radiological Divisions 25 Be, Malcolm Dante? Radioisotopes

'Viszon+ 2 Dr. Méxino Cerame Vivae Assistant Professor of Biology University of Puerto Rico 9 Alfreds Torzuella Lecturer, Physics Department University of Puerto Rico Wr, Fon6 Noel ores Padsotnerapy and Cancer Division" SUL OF ae The tengue Epidemic! fon Effects tr Jaidazoles ac Enayeatic Models for Phospravase Activity ody of Bazan Turomozones Effects of Aging on DNA. Fate of Excited States Toe Effect of the Melanocyte hormone on the Genetic Properties Of Teolated Frog Sein Lung Tumors Significance of Persistent tumors in the Vaginal Smear of Patients Treated with Radiation for 'actinona of the cervix Uteri Photochemical Actions of Naturally Occurring Pyrimidines distribution of Benthic Marine Invertebrates Nuclear Forces Theoretical considerations of Budiology Applied to finan Jareor Hadlovtherapy ---Page Break--- 23 br Robert A. nse, Head Agricultural Biosciences Division® 30 Br, Robert A. Svevenson Associate Scientist Marine Biology Program\* Nov. 6 Dr. Ff Ranfrez Chief, Medical Services San Pacific Veterans' Hosp. 13 Dr, Ravin Fo: Radiotherapy, Bend Bevelent 20 Dr. Addn Magaglioni, Dean School of Medicine, "U.P.R. 2 Dees Jeanne vesias Baddotherapy & cancer Day-\* a Orlando Bonita School of Medicine + Puerto Rico Nuclear Center 'TEMRE op geccne Epiecte of Low Prerey Trays fon Biological Systems table Element Composition of Marine Animals and Plants Sorenary Insufficiency SeLP-Association of Dimethyl Sulfoxide Recent Advances in the Study of Gastro-Intestinal Diseases World-Wide Fallout in Marine Samples from Puerto Rico Amenocarcinomas of the Uterine Cervix The Immune Globulin-Structure, Function and Tannino-Electrophoretic study Radiationless Transition Rate Constant in Anthracene ---Page Break--- van. Fee. 20 7 2 a PRNC

Weekly Seminars - Mayaguez gewweRp De. Joke 6 Director® Dr. dD. Gar: Associate Director  
Agricultural Biosciences Dr. Leopoldo 8, School of Neal Mine, recede HP. Dr. Berminto Bre:  
Radionuclides Applications Mey J. Pazriila cade: Health Dr. loute Krumote Department of Biology  
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Relationship Studies Applied Research in Atomic 'Technology Dosimetry of X and Gamma  
Radiation Agatic Radioecology Some Aspects of Darcy's Law and Microwaves ---Page Break---  
DATE Feb. 28 Mazon 7 w a ea april a 1B 2 May 2 9 ieraueee Ee. Mahendea Singh Agricultural  
Bio-Sciences Division Me. P. Matior Babadeneiza clear Science & Technology Division Head,  
Reactor Division\* Dr. Duane B. Linder Agricultural Bio Division re oe Ae Facets Nuclear Science &  
Technology Division Dr. 7. Maldonado Caprites Director, Biology Department can De. Robert A.  
isee agricultural Bio- Divisions Miss Marfa M. Patactos Radiotherapy & Cancer Division\* Dr,  
Norman E. Delfel Federal Experiment Station Mayaguez Dr. B. By Kntent Nuclear Science &  
Divisions biology Dr. Frank ç, omar Marine Biology Program\* Dr. ¥, ¥, Ragan Physics Dept.,  
College of Agriculture & Mechanic Arts Mayaguez Drs J. Ay Rivere Biology Dept. CAMA Mayaguez  
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Radiation-Effect on invisibility Marine Contamination Principle Theory of Quantum Field The Role of  
Sound in the Behavior ---Page Break--- DATE 23 30 Jane 6 ar aly 1h 8 22 Sept. 5 Dr. Fever Lynn  
Marine Biology, CAMA Mayaguez Dr. Bide Orde Nuclear Science & Technology Division Dr. Frank  
&. Lowman Marine Biology Program De. W. Garcia Morin Chemistry eps. CPR be. M. Maz Paferver  
Biology Dept., CAMA Mayaguez De, . Barry Sanany Radioisotopes Application Divisione Dr. M.  
Diaz terres Biology Dept., Cad Mayaguez Dr. de F. Stucs agriculture? sciences Divisions br. 0. #.  
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Aplicación de la Resonancia

Magrética del Frovén en la Determinación de Estructuras Moleculares, Ciclos Reproductivos y la  
Dinámica de Comunidades Marinas. Redo Experimental para determinar la Energía de Enlace en  
la Contaminación Marina de la costa Oeste de Puerto Rico. Investigaciones sobre la Excreción en  
Monocastrados: Efecto de Isótopos en la Cinética Química. ---Page Break--- Para Sept. 12, 6 ost.  
3, 10 ov. aL us URE ye, B.S. Frazer, Ciencia y Tecnología. División de Ciencia Nuclear, Sr.  
Gonzalo González, Ciencia Nuclear y Tecnología. Sr. O. Anglers, División de Ciencia Nuclear y  
Tecnología. Dr. Carlos Aguaye, Departamento de Biología, Colegio de Agricultura y Artes  
Mecánicas, Mayagüez. Sr. Rad Mclan, Programa de Biología Marina. Sr. S. Partita Calderón,  
División de Física de la Salud. Sr. G. González, Departamento de Biología, AMA Mayagüez. Dr. A.  
Hy Saith, Dr. F. Vélez, Ciencia Nuclear y Tecnología. División. Sr. B. Pinto, División de Ciencia  
Nuclear. Dr. Morris, Rockstein, Universidad de Miami. Difracción de Neutrones en Cristales  
Ferroelétricos. Modificación de un Fijo de Neutrones que Frengen de la Parte Superior de un  
-clusna. Temas sobre Radiación y Seguridad en el Desarrollo y Uso de Energía Nuclear para  
Propulsión de Cohetes. Distribución de los Moluscos Terrestres de Puerto Rico y Cuba.  
Determinación de 132 en Leche. Shseidine contra Fallout. La Importancia del Fitoplancton y Algas  
en el Estudio de Océanos, Fond, Salacuce, Mes. Estudios Citogenéticos Comparativos con  
Neutrones. Técnicas Empleadas en el Estudio de Resonancia en los Efectos de Radiación con  
Rayos X. Determinación de Media Vida de Isótopos de Forenatl. Envejecimiento influenciado por  
Factores Externos (Radiación, etc.) ---Page Break--- Dae San. Fev. March April 24, 30 a ab 20 a.

LECTOR Dr. ¥. Conten, Director del Observatorio Atmosférico de Arecibo. Sra. B.J. Santiago de Morales, División de Física de la Salud. Dr. Fatlip Sadtier, Fres., Laboratorios de Investigación, Pennsylvania. Dr. Joseph Simone, Profesor de Química, Universidad.

of Florida Mr. J. Parrilla Caldera Research Associate Health, Physics Division Dr. HJ Deputy Soubens restore Dr. David Waker Associate Professor Biology Dept., U.P.R, Dr. Frank Martin Federal Experiment Station Mayaguez M. Silagros Maré Mislear Science & Technology Division Dr. Job D. Weaver Professor, Geology Section CAMA, ULELR, Mr. B. Pinto Yeas Ingeniero, Physics Dept OP. Dr. Heber A. Luse Agriculture Bio-Sciences Division Ems op LECTURE Radiastronomy and the Terrestrial Ionosphere Determinación de Fenoles Libres y Combinados en Plantas Irradiadas Infrared - A Powerful Tool 1¢, Time and Energy Calorimetry Determination of Energy Absorption Buildup Factor Resonance in Radiation Effects Sterilization of Insects A Theory of the Physiological and Genetic Control of Unilateral Incompatibility Efecto del sulfito 'iprico en la Estabilidad del Dosimetro de Sulfato Gérico hanging Seu Levels in the Caribbean High Coma Energies Neutron Conversion Device for Half-Life Measurement Isotope Dilution in Sugarcane Research ---Page Break--- DATE April 27 June 13, 2023 Sept. STEERES Dr. Juan Goléa Avilés Agronomy Dept, CAM eR br, George W. Miskimen Polar Experiment Station Mayaguez Father Ignacio Cantarell Nuclear Science & Technology Division Dr. Carlos Aguayo Biology Dept., CAMA UPR Mr. Arturo Riotlano Teabela Sub-station UPR Dr. B. C. Frazer Nuclear Science and Technology Division Dr. S. Ye Tyree Professor of Chemistry University of North Carolina Dr. Richard Biebl Plant Physiology Institute University of Vienna Mustrie Dr. Justo Hernández-Mora Professor of Chemistry UPR Dr. Julie A. Gonzalo Mislear Science & Technology Division Dr. Max Witson Professor of English and Humanities, UPR Dr. Stanley Botner Professor of Psychology UFR some of the Nitrogen Fraction of Soils Zoogeography of the Coleopterous Family Chaslichgnathiaae "Método para Controlar la Patten en Tubos Fotomultiplicadores" "Los Organismos de la Fauna Antártica" Improvement of Pigeon Peas Garouge Breeding and Crop Management Impressions on a Visit to the Soviet

Union 'The Problem of Valence State Polarization Energetics Protoplasmic Ecology of Marine Algae Bone Aspects of the Chemistry of Synthetic Drugs Statistical Theory of Ferro-electricity in Triglycine Sulfate Colloquium on the Philosophy of Science Research on the Effects of Magnetic Fields on Animal Behavior ---Page Break--- Oct. Dec. Jan. 20 u B 20 icone Dr. Malcolm Daniels Radioisotopes Division Dr. Arador Covas Associate Director Dr. Osvaldo Villafañe Professor of Mechanical Engineering, CAMA, UPE Dr. Sergio Irizarry Head, Clinical Applications Division Mr. Rafael Montalvo Nuclear Science & Technology Division Dr. J. B. McCandless Physician in Mayaguez, PR Dr. K. S. Koo and Dr. Duane B. Tinden Agricultural Bio-Sciences Division Dr. S. Delisle Biochemist, Federal Experiment Station, Mayaguez Dr. Owen H. Winceler Acting Head, Nuclear Science & Technology Division 1964 Dr. Margaret Sweeting Lecturer, School of Geography Oxford, England Dr. Florencio Vizquez Nuclear Science & Technology Division Dr. Paul Weintraub Head, Medical Sciences and Radiobiology Division Eng o" waowRs Recon? Developments in Radiation Chemistry Measurement of Radiation Damage in Anthracene Crystals A Survey of Experimental Stress Analysis - Development, Scope, and Methods Effect of Radiation on Intestinal Absorption in Humans Measured by T-131 Tagged Fatty Acids Barium Labeling and Counting Techniques Ecologies of Cartagena Lagoon Their impressions of the Eleventh International Genetics Conference held at The Hague, Netherlands, Sept. 2-10/63, Research on Effects of Phosphon, Hydrazide on Sugar Cane via Electron Paramagnetic Resonance Development of Limestone Topography in the Tropics Band Theory of Solids Field Techniques in Arbovirology ---Page Break--- DAE Fe. 3) 0 uv April 6 a3 20 a LECTURER Dr. Prarie C. Lunan

Head, Marine Ecology Program Dr. Howard T. Sauer Director, Terrestrial Ecology Program: Part 1  
Dr. H.D. Graben Professor, Department of Biology, SAYA, UER Dr. V. A. Marcial, Head  
Radiotherapy & Cancer Div. # Dr. D. S.

Sasecer Dept. of Nuclear Engineering Towa State University Dr. C. Miskineon Entomologist,  
Federal Agricultural Experiment Station, Mayaguez, F. Re br. Robert Stevenson Marine Biology  
Program Dr. Owen He Wheeler Head, Nuclear Science Technology Division and Dr. Juan P.  
Facetti Nuclear Science & Technology Division Dr. Allan Philips Department of Agricultural  
Engineering, CAVA, UPR Rev. Ignacio Oantaret Nuclear Science & Technology Division Dr.  
Francis K. B. Ko Agricultural Soil Division Prof. Kenneth Soderstrom Director, Dept. of Mechanical  
Engineering, CAMA, UPR Elements of Marine Organisms in Sediment's Chronology in Ecological  
System Studies on the Reactions and Termination of Natural Plant Hydrocolloids Cancer in Puerto  
Rico Gems Gransier in the Vicinity of Voids in Shields Zoogeography of the Soldier Beetle Stable  
Element Analysis of Marine Organic Compounds. Mechanism of Tritium Labelling of Organic  
Compounds Salari-chalmers Reactions in Inorganic Compounds of Phosphorus, Arsenic, and  
Antimony Shallow Bins for Drying Coffee Research Possibilities with Low Energy Accelerators  
Nuclear Volume and Radiosensitivity Temperature Rise in Fuel Elements of the PRIC Reactor as a  
Result of Immediate Loss of Water ---Page Break--- Sept. Oct. Nov. 10 yw ay a2 9 23 30 TRUER  
Prof. D. J. Wimberly Biology Dept. CAMA, U.P.R. Dr. Juan P. Facetti Science & Technology Dr.  
Julie A. Conzaio Nuclear Science & Technology Bioviotics Dr. Morvimer T. Kay Neutron Diffraction  
Program Dey Andrew Karetard Agricultural Bio-Sciences Division Dr. Pavia My Walker Agricultural  
Bio-Sciences Division Prof. J. Southern Anoros Antnote University Dr. Harry Sauvart  
Radioisotopes Division Mr. Ameldo de Koyes Maclour Engineering Div. Prof. H. Troshe-Maldorado  
Physics Department CAMA, ULF. Dr. Peter Paraskevoudekis Health Physics Division Dr. B.  
Graben College of Agriculture and Mechanic Arts, U.P.R. Mr. Michael Titeat Health Physics  
Division Ms. Bortque Avila Marine Biology Program 225 of Igomae The Marine Geology of  
Southern California

Salutation of Activities of 'samples Irradiated in the Reactor Neutron Diffraction Study of Magnetic  
Spiral in Manganese Dioxide Neutron Diffraction Study of the Structure of Hydroxyapatite and  
Calcium Iodide 'Amino Acid Composition of Pinguinain. An exceptionally small catalytic enzyme  
Prenuptial Behavior in Inset 'Thermal Expansion in Relation to Crystal Structure Solvent Effects in  
Chemistry Numbers from a Radioactive source of Dielectric Properties of Some Ferroelectric  
Ceramics Catorimeter Design for Soft X-rays Metabolism of Sugar Alcohols and Some New  
Methods for Their Determination Localization of Brain Tumors by Phenomenography and  
Ventriculography Optical Activity in Crystal Primary Production in the Sea ---Page Break--- DATE  
SIKER Dec. 7 Dr. Frank L. Lowman Director, Marine Biology Program 2B Dr. A. S. Posner Cornell  
University Medical College \* Puerto Rico Nuclear Center OEE of World-wide Fallout in Marine  
Organisms Toe Change in Crystallinity of Hard Tissues with Fluoride Uptake ---Page Break---