

PRNC050

JOHN C. BUGHER PRNC 50

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PUERTO RICO NUCLEAR CENTER

TRAINING AND EDUCATION PROGRAM OUTLINES.

Volume

AEC Ad Hoc Committee for Program Review

October 15-16-17, 1964

?OPERATED By UNIVERSITY

NO. AT (40-1)-1833 FOR U.

JERTO RICO UNDER CONTRACT

. ATOMIC ENERGY COMMISSION

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see 1

Radioisotope Applications Division

CLinteal Applications Division ...ssseeseeeeeen 2

Medical Sciences & Radiobiology Division ... 3

Radiotherapy & Cancer Division seeseeee 4

Reactor Division

Nuclear Science and Technology Division 6

Nuclear Engineering Division 1

Health Physics Division «+... oe 8

Agricultural Bio-Sciences Division sesseseeseeeeereete 9

International Nuclear Energy Exhibite « 10

october 1964

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OUTLINE OF MATERIAL TO BE PRESENTED TO

AEC Ad Hoc Committee for Program Review

RADIOISOTOPE APPLICATIONS DIVISION

Dr. Edwin Roig, Head

I. General Scope of Review

Euphasis will be given to the achievements of the Division in fulfilling
the main function as training center.

£9 be considered

A, Additional laboratory space

11, Factor

Organic Chemistry

]. A new temporary construction with an area of approximately
1600 sq. ft. at a cost of \$15,000 including Laboratory benches, 4 hoods, and air
conditioners, was finished at the beginning of this fiscal year. At present 7
persons are working in this laboratory; maximum capacity is 14,

b. Part of the original 9

; the remaining space:

that was used for organic chemistry

we are using for instrumentation

2, Radiation Chemistry and Photochemistry

4, The 2700 curie Co-60 source was installed in the irradiation basement during last FY. Access to the room has recently been modified substituting the spiral staircase for a safer type along the sides of the wall. This modification allowed for the installation of 2 platform to be operated by a hoist thus providing a practical and safe means for transferring equipment to and from the basement. We are now providing safety requirements to allow for the utilization of the irradiation facilities:

b. Since January, 1964 this group has acquired a laboratory at the Chemistry Department (our old Radiochemistry laboratory) - 800 sq. ft. This Lab is planned for organic photochemistry and flash photolysis under the NIH grant. Construction of the flash photolysis set-up is nearing completion. At present two

percone are working in that leboretory; maximum capacity - 6, This Leboretory at the University hs released the crowiness in our facilities in this building.

B. Scientifie Personnel

Please refer to Table I summarizing the present staff situation, including the Level we expect to reach with the existing facilities, Reference ia ?leo made to nuaber of students partictpating and naximim number of students that can be supervised under the different research prog

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Cs Collsborstion given to UF

car ota? participates actively in the activities of the sefence
departments of the University of Puerto ico. They purtictyate in the teaking
of university courses. The following teaching loud of the present ceademic year
ie typtcal of our ectlabsration:

stert

ber course

grait hours

Dr. Bavin sot Quantitative Analysis (undergraduate)

Dr. H. Harry Sumant Crgante Chenistry (undergraduate)

Theory of Organis Caomistry (graduate)

Physico Chemical Busts of Biological

Processes (undergraduate)

Dr. Waleoln Deniele Advanced Physical Chemistry (graduate)

The folloving staf? nenber

ave supervising Master's research:

= 2 graduate stutont

= 5 geadante students

= i graduate student

on from UFR

The following staff members from the University of Puerto Rico hold
ad-honorem appointments at PHOIO and participate in the teaching of some of our
courses, and in our research programs

Department

Dr. Juan Dentel-Caret, Dean, College of Natural Sciences

Dr. Iec Grimizon-Cheatey

Dr. Ialdemar Agar-Cheatey

Dr. Graciela C. Candelas-Biology

Dr. Form instruction

Our Courses

a. Basic Reductase Techniques course - has been incorporated in
the graduate curriculum of Microbiology and Biochemistry at the School of Medicine
as a two-credit course. Other participants receive no academic credit.

b. Radiochemistry ~ taken by advanced undergraduate and graduates
of the Chemistry Department, is credited.

fe» Nuclear Techniques in Biological Research ~ taken by advanced undergraduates and graduates of the Biology Department, 4 credits.

a, Radiological Physics - taken by Residents in Radiology from the University of Puerto Rico; offered when requested.

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2s Teaching staff

Members of other PRIC divisions and of the science departments of the University of Puerto Rico collaborate in the teaching of courses. The institution will take care of and the collaboration will continue since it is impossible for the Division to have among its members specialists for all the topics covered in our courses. The persons more involved in the teaching of courses follow:

Name Division Special field

Br. B. Rotg (Ph.D.) _?_?Radiotectopes Radiochantstry and

Instrumentation

Mrs. Rosa S.Tiredo (14.8. Radiotectopes Radtochemistry and

Instrumentation

Dr. Re inse (PasD.) Agriculture] Bio-sclences Radiobiology

Mise Z. Frias (1.S.) Radiotherapy ené Cancer Statistics

Mrs. G. Candelas (Wi.S.) Biology Dept. (U.P.R.) Radiobiology

Mre. M.P. Lozano (I,S.) Tadictherapy and Cancer Paysice and Health Physics

Mise H. Pubén (¥.5.) "Health Paysites Paysica end Health Physics

3. students

4s Please refer to tables IT and TXT and Graph for an analysis

of participants.

bs Coments and conclusions

(2) significant increase in Fr 1965 ~ due to ten students

fron the Dastnicun Republic who cass 220 group in an arrangenent through the

University of Pusrto Rico to participate tm our baec course. Also telve PMC

employees took the basis course. This number, large as compared to other years, is not typical. Regarding the above events, which may be considered as special, the general trend of increase noticeable since 1962 brought the total number of students to a figure in the low forties.

(2) The significant decrease in 1964 is mainly due to

① sharp decrease in the U.S.A. citizens. We must wait until the end of this

year to analyze this situation. It could be that the local demand is being satisfied. However, recently the local sugar industry has shown interest in having their scientists trained in nuclear techniques and we are already receiving applications for said training. This training will require the basic Radioisotope Techniques course as an introduction to more advanced training in the bio-agricultural division,

(3) As expected, the total number of participants in the elementary course (elementary level) has decreased.

(i) the participation in academic courses (University credit)

has reached a plateau of approximately ten students. This will remain in coming years since it shows saturation of the laboratory facilities.

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PARTICIPANTS IN FORMAL COURSES

(este course, Radtochemistry, and Nuclear Techniques in Biological Research)

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GE avin american WS wer... seusenens

Analysis by Plelés of vork

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37H2H>0F

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Sd

(5) Latin Americans participating in our course are mainly from the medical field.

(6) Local participants come mainly from Ghent University and Biology.

For Research

2s General comments

We are convinced that in order that we may contribute to the thoughtful development of Puerto Rico and of Latin America it is necessary that we first establish a continuous and high-level research program so that the

State institution, on its own merits, becomes an attractive training center, the Radioisotope Applications Division believes to have come a long way in this direction and support for this belief will be presented to you by the individual program leaders. Some of the aspects which we planned to promote, such as the use of the molecular reactor as a research tool in nuclear chemistry and the use of the Co-60 for radiation chemistry, are still lagging behind schedules due to different reasons: (1) the lack of space for organic chemistry (secured recently with the new laboratory:

which was originally planned for this summer and had to be postponed because of its assignment to FRUC and also due to financial difficulties; (2) the

delay in modifying access to the Co-60 source,

2 Student participation - Refer to Twble TV.

3s Research projects

Ss Organic Chemistry - i. rey Samant

(2) organic Boron Compounds (A. Carrasquitio, Rescarch

Mpletant, MOC an graduate otudent: Department of Chemisty, UP.2.) = sepa

ration of vater soluble derivatives of boric ead cubvberte acid.

(2) organte sulfur compounds

12) Dre Seymour Ss Block, Oak Ridge Research Partict-

?wattion Program Fellow, July-August, 196; Metallic Chelates of auieciaen

(b) Drs José P. A. Castrit6n (Argentina), Associate

Sciartist, uc: (4) Exchange of oxygen between sulfaxides ant sultides, (11) Res

Guction of sulfoxides by triphenylphospaine and carbon tetrachloride,

(c) Mrs Osvadio Cox, Graduate Student, Departient of

Chentatry, U.P.R.: Reaction of Sulrarides by Triphenylphosphine,

(2) Mise Uetiant ortiz, undergraduate student, Depart

?Rent of Chemistry, U.P.R.; Petroleum Research Fund grant of the American øherveey

Socctety: Reaction of ?Carbondiimides with thionyl ehisride,

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?woysormng ADsoiRT opuORY TeuoFamuTOWUE 24% Ay parosUods om oqUEpNAS On04 50

SORE

smatoar uoTyedrorraand MEIGO £4 paxosvods ø

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(e) try J. J. Rtgou, Research AcsLetant, FRC

nd greduste student, Deparinest of Chemistry, U.P.R.; Structure of the

Seomeric 2-phenyloulMaylindanol.s.,

(2) Mee Rs 4, Figueroa, Research Assistant,

PRIC, and graduate student, Department of Chemistry, UsP.R.j Dre Be Rog:

Association of Sulfoxides with Phenols.

(3) Mcleophtlic Substitution Reactions of Datdates

(vintional Institutes of Health Grant) - wr. Tate Brave Navarrete (Chile) end

Miss Adele Youskad, both graduste ctadexte, Department of Chemistry, UPR

(4) Solvent Effects in chemistry

(a) Mes, Yolande Yatlant de Candelarto (Cubs),

Research Assistant and graduate student, Department of Chemistry, U.P.Re: A study of the monosodium salt of phenolphthalein.

(b) Mire vite Ronin, graduate student, Department

of Chemistry, U.PsR.: Solvent effects in the Wolff-Kishner reaction.

in Photochemistry and Radiation Chemistry

(2) oxyanion solutions - Mire Viek Meyers, Research

Associate, FIC, and Mrs. Bleriyne V, Belardo, Research assistant, ENC

(e) Photolysis of Nitrate at 300nm: Effects of!

Concentration, intensity, pi and scavenger.

(2) DAWA, and Constituents

(a) Photo oxidation of thymine at 18K9°A - Dee

Alec Grimiscn, Associate Professor, Chemistry Departeent, UPR, and Associate Scientist, ed?honoren, PRNC; Miss Steriyna V. Belanio, and ire. Avilda Re Sandoval, Research Assistant, Chenictry Department, U-P.Re

(b) Pototeeminstion of cytosine at 2537°A: Deam-

nation kinetics ~ Dr, Alec Grisison ané firs. Avilda R. Sandoval.

(c) amtnessonce of eytosine in aquecus solution:

Giscovary of, pit dependence, quenching kinetics. - Dr+ Alec Grimison end Mrse Avilda Ry Schdoval

ihe

(A) umineseceace of teymtne and Br, Alec

Grinteon and Mrs. jvilda Ry Sandoval.

(c) Deantnation of Datl.A. at 537° - German

Santiago, Graduate Student, Chentvtry Department, U.P.Re

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?ae

(f) Energy Transfer between Cytosine and

?myrine - Dr. Alee Grintson and is. Avilda R Sandoval.

(e) Viscosity and optical Studies on D.N.As -

Mrs. Bterlyma V. Belardo and Hrs. Avilde Rs Sandoval.

es Solid State Physics Project of organic Crystals

(2) Equipment

Equipment has been built to purify anthracene by

sublimation and zone refining and to make crystals from solution and from the

melt, Equipment has been built to make steady state and transient measure-

ments of electrical conductivity in anthracene crystals.

(2) Measurements

Steady state measurements of electrical conductivity

of anthracene crystals using the Lillmann-Pope iodine electrode indicate that

the conductivity increases after irradiation of neutrons. There does not seem

to be changes in mobility of carriers measured using transient techniques, Plans

are being made to make these measurements after irradiating with gamma and

rays. Measurements will also be made in other organic crystals.

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B. Rotg, loG, Rieckehof!, C.S, Musso ant J.D, Curet, J, Chem. Bis, Vol. 38,
3961, ps 350s

me Radiation Chentetry of Argenite, Pts II, Oxygen-Pree Solution",

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?he Douteriun Isotope Effect ia the Wydrogen Bonding of Tntdazole

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Lee Grinstead, RIC.

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of Arsenite Concentration in Oxygen: Daniels, J.

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The Wolff-Kishner Reaction of hydrazones", J. A. Samant, J.

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Informe Acerca de las Reacciones Clásticas y Tensiones Tánicas

Américas - Guineas", in conmemorative volume published by UNBECO, Centro

de Cooperación Científica para América Latina, Montevideo, resumando the

activities of "Grupo de Trabajo para la Selección de Investigaciones Científicas

latinoamerican", in don Juan,

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?OUTLINE OF MATERIAL TO BE PRESENTED TO
AEC Ad Hoc Committee for Program Review

CLINICAL APPLICATIONS DIVISION

Dr. Sergio Irizarry, Head

1, Purpose and Scope of Program

The main purpose of the program of this Division is teaching
and training of Latin American physicians in the diagnostic and

therapeutic u

8 of radioisotopes in humans. This goal is

Accomplished in two ways:

1) providing special training courses of basic

clinical radiological techniques for the diagnosis and treatment

of human diseases

2) providing special training in clinical research.

2. Types Training available

Introduction

Initially this Division began operating under

the direction of Dr. A. A. Cintrón Rivers in 1958 at the Radiology

Department of the School of Medicine at the San Juan City Hospital. A

total of 36 trainees have completed the clinical course, of which 28

have come from various Latin American countries, Table I.

The average output of trainees during the past 7

years has been 5 per year. Graph I.

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?

to.

?Argentina

Bolivie

cutie

Colombia

Costa Rica

Dominican Republic

Cuntenala

|. Mexico

|. Uruguay

Venezuela

orl

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?Type Courses Available

?There are two general types of courses available

according to breadth and scope of the course: orientation courses and

training courses, Considered in the light of duration and type of

training desired evo courses are offered:

A short 4 weeks or 8 weeks

fe elintea applic

ations training course or « long 6 months to 12 months clinical research

training cours

Description of the Courses:

?Tae Shore Course

The abort course is basically « 2 moathe

program consisting of lectures, desonstrations, informal pr
laboratory exercises for training and periods of discussion. Baphasia
ts placed on mastering of cechniques, their indications and uses,
correct interpretation, Limitations and correlation vith clinical

problems,

The 8 weeks course contemplates the completion of 80 laboratory exercises in which a wide variety of techniques are employed. A list of the teaching units covered by the Laboratory

procedures utilized appears in table IT.

---Page Break---

Unit of Study

1, Thyroid Function

routine uptake measurements as)

assay radioactive blood thyroid

hormone levels as)

modified teste of thyroid function(5)

2, Dynamic functions of the hepatic,
renal, and vascular systems

3, Hematologic applications of
radiotsotopes

4, Tumor localization studi

5. Gastrointestinal absorption

6, Electrolyte and Fluid balance

7. Terapeutic procede

38

20

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?AG weeks course, of similar nature to the 8 weeks course, is also given. The procedures are similar but the total number of training exercises is cut in half, 40 that 40 teaching exercises are completed by each trainee

?The Long Cow

?There are two long term courses

12 being offered by

this Division:

?As Semester course for medical residents; orientation

in medical uses of radioisotopes.

= Semester to 1 year course in clinical research.

Description of courses

The Semester course for medical residents is a non

credit course designed for orientation in the medical aspects and uses

The

of radioisotopes for diagnosis and therapy in clinical practice

consists of 12 sessions 2 hours

consists of 20 hour lecture #

?each for laboratory denonatratio:

The Semester to 1 year elinfeal research course is

offered to candidates ho have had already gone thru the baste training

?At Puerto Rico Nuclear Center or elaeuhere, and who want advanced specialized training in clinical research, The trainee vould have no formalized teaching, but would be assigned apecial responsibility within 4 project being carried out at the Division and be supervised at regular intervals to evaluate progress being made and for the solution of Problens that may arise during the course of the Lavestigation. The trainee aay have « special problen of his own that he would Like to

Anventigate, In chis case he discusses his project with us for «

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decision as to feasibility and scientific value. If approved he

ie given the necessary assistance and supervision for its completion.

The trainee is responsible for the design of his project, selection and standardization of the method, collection of the data, analysis and reporting. A final report at the end of the year is submitted to the Director for evaluation and publication if it fulfills the requirements for @ communication.

New Proposed course:

Following the previous recommendation of the Bio-

Medical Advisory Committee, the Division is setting up a special

advanced course for training in renal pathology. This is a 4 week course offered to candidates with previous experience in the field

Of nuclear medicine, who want « specialized training in the particular

area of renal diseases. Registration capacity for full training is

4 trainees; the course may be offered twice a year, for at least 2

years, before another course of similar nature on another subject 1

1 organization of the course allows the first week

prepared. The

to a general review of nuclear physics, mathematics and statistics

?the second week covers the pathologic and physiologic aspects of the

renal apparatus; the third week defines the clinical pictures of

various pathologic entities, and the fourth week is dedicated entirely

to radioisotope techniques for the evaluation of renal function.

A second new propos: As a general cour

of orientation te Nuclear Medicine of one week duration, This course

Antended for the general practitioner and doctors in other medical

ecialties, The subject matter of this course will try to cover the

---Page Break---

general applications of radioisotopes for diagnosia and ext

As current use in medical practice. Demonstration end case presentations will be used to strengthen the theoretical presentations.

A program of each of the formal courses described

above is appended. Appendix A.

Diagnostic Service Load and its relation to training courses

The laboratory, as already mentioned, began operations in 1957-58

at which time a total of 438 diagnostic procedures were performed.

Since then, yearly reports indicate increase output in the diagnostic service load until the years 62-63 and 63-66 in which the output

levelled off at or around 3,300 procedures 8 fold increase.

This is illustrated in Chart I, graph 2.

The diagnostic load has always been considered a necessity for the training program. It is generally admitted that the necessities of

the training program can be well met by a ceiling of 200 diagnostic

Procedures per month. This level of activity had already been reached by 1960-61. An increase beyond this level during the past 2 years can be explained by the combined operations of the University Radiology Unit and PRC Clinical Applications laboratory. It should be mentioned

that a semester course for medical residents of general orientation to

the clinical uses of radiotopes was completed by 26 participants of the University Hospital. A new course is scheduled for the next semester January - June, 1965.

and in all instances

Training procedures are performed by trainees

whenever possible, parallel run is made by the instructor for control

of technique.

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Page 1

BY YEAR

FLDJ CHART DIAGNOSTIC PROCEDURES BY

GASTROMNTESTINAL

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LIZATION

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2680 3092312642

1623

438

No statistical date

September 17, 1964

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nh.

to the Flow chart presented before, training procedures make

substantial figure of total diagnostic load from which it is taken.

?This is more apparent in the last few years during which time we have

had better reporting of this activity.

The

1, Thyroid Function Studies

2, Cardiovascular

3. Kidney Function

4, Liver functions

5. Hematology

vaching procedures include the follosing cechoiques:

uptaies, 2, 24, 48 hours

PEI-131 Conversion ratios

eer-131 plasma levels

EONS discharge test

TSH stimulation test

Teiiodarhyronine suppression cest

Iodine inhibition test,

Thyroid Scans

Cardiac output

Stroke Voluse

Cireulation time

Central Voluse

Circulatory rates for shunts

Cardiac scanning

Rippurate [+131 renogran

Neohyéria lig 203 renogran

Blood clearance

Benal scans

Hepatogran

Liver uptake, excretion,

Eneeatinal eatey eine,

Blood clearance

Liver Blood Flow

Liver scanning

1 Blood volume, red blood

ded cell survival

Splente uptake

Th vitro aed cell uptake

Gastrovintestinal blood loss

Splenic scanning

9 Tron Plasma Clearance

Daily plasna tron turnover

Red blood cell tron upcake

= Red cell iron arnover

?Total red cell iron

Percent hemoglobin renewal per day

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2

Total hemoglobin formed

average red cell life epan

Total circulating hewoglobin

6, Gastrointestinal function = absorption Vitamin B=12

+ Ausorption labelled neutral f

fatey acide (Olete T-131 and

exfolein 1-131)

Blood curve absorption levels

Urinary excretion levels

Stoolyelimination of radioactive fat

and

7. Tumor Localization + Gemma-seintigraphy

Paper dot cesnning

Photo dot scaaning

= Gneau-phote-rad iography

Ocher sethods of tuner localization

© Progress in instrumentation

8. Electrolyte Balance and

Fluté Compartaencs Plassa Volume

Extraceiluler volume

Total Body water

Intracellular volume

Sodium and Potassium turnover

and exchangeable pools

Sodium compartment

9, Therapeutic procedures

Hyperthyroidism

Cancer of the Thyroid

Intractable Coronary Disease

Polyeythemia Vera

Chronic Leukemia

Pleural and Peritoneal Malignant

Effusions

Research Program

A number of clinical research projects are being carried by the Medical Staff of the Division on patients referred for diagnostic

studies or on patients undergoing treatment at the University Hospital or the I. González Martínez Oncology Hospital. The rationale for this activity is that it enters into the teaching material offered the trainees

in the various courses

» In the formal presentations or at informal

discussions, Trainees are

encouraged to design and carry out their

own projects. During the last training course given at this Division

two new proposals or projects of investigation were submitted

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a.

result largely, of initiative of the trainee

proposals

1, Clinical and Radiological Evaluation of the cardiovascular States in Diabetics - initiative in part of trainee Dr. Mario Iturralde from Bolivia.

2. Thyroid Metabolism in Endemic Goiter in Mexico, initiative in part of trainee Dr. Antonio Quiñones Blanca from Mexico.

The project of the clinical and radiological evaluation of the cardiovascular states of diabetic patients was approved and is under way, The project for the study of endemic goiter in Mexico is under

consideration for approval pending financial support.

All other projects are tuned to the needs of the teaching prog:

?This relation ts best shown {f ve compare the unite of study of the

?various courses and the project title of the clinical studies, This

is given below, cable III.

ran

Comparison Unite of Study for Training and Projects
of Investigation

Units of Study-Clinical Applications Project

1, Teste of Thyroté Function = Clinical and Laboratory Evaluation

of Thyroid Disorders

+ Evaluation of in vitro ceate of thyroid funetion for use aa diag-
nostic procedus

+ Study of the effect of anci-
conceptive eherapy on the 26
hour I-131 thyroid uptake

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cardiovascular

Kidney funetion

Liver funetion

Gasero-intestinal function

Hematology

Tumor Localization

Electrolyte Balance and

Fluid Compartments

Therapeutic procedures

os

Coronary blood flow in

anemia

Cardiovascular studies

in diabetics

Renogram follow up Study

in Cancer of the Cervix

Combined clinical, renographic

and scintigraphic studies in

kidney diseases

Renogram studies in diabetics

I-131 Rose Bengal localization

studies ~ scintigraphy

?The effect of radiotherapy

on intestinal absorption of

Iodine 131 labelled folic acid and

Vitamin A (in humans).

The thyroid gland as an

indicator of intestinal

absorption of I-131 labelled

folic acid

Instrumentation improvement

Organ and tumor localization

Electrolyte and fluid disorders

leading to diarrhea.

Electrolyte and Fluid Balance

in women under contraceptive

therapy

Review of Patients treated

with T-131,

eed

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Advanced Course in Nuclear Medicine:

BADIOISOTOPES IN RENAL DISEASES

The Clinical Applications Division of the Puerto Rico Nuclear Center will offer an advanced course in Nuclear Medicine applied to

the study of

the renal apparatus. The course contains

an introduction unit which will review basic aspects of nuclear

Physics. This will be followed immediately by a work shop in anatomy

and pathology study of renal morphology, normal and abnormal, with presen-

tation of pertinent illustrative material derived from surgical

specimens and related to clinical pictures and case discussions.

This area will be taken up in two units

A Unie of anatomo-pathology studies of the kidneys, in which the basic considerations will be the study of normal anatomy of the

kidney which includes: gross

anatomy, histology, embryology, anatomy=

pathology of the kidney, physio-pathology and special techniques of

histopathology (histo-chemistry)

B. Special syndromes or clinical pictures of renal diseases,

This includes

nephritis and nephrosis, metabolic dis

orders, vascular

reer

and obstructive syndromes, including tumors and renal

infectious processes.

The fourth unit will be dedicated to the study of the renal

apparatus by the use of several radioisotopic techniques

+ Emphasis

will be placed on methodology of the different tests and their interpretation and correlation with physio-pathologic mechanisms

presented or demonstrated in the various clinical pictures

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The duration of the course is four weeks, with 18 hours for

lecture time and 116 hours for practice, demonstrations, discussions,

seminars and other activities

The course will be offered utilizing various methods available for

transmission of information, This will be based on the formal lecture,

panel discussion and methods in which the active participation of the

trainee will be encouraged, such as case presentations, bed-rounds,

rounds, discussions, laboratory practice and clinical evaluation and

work up of patients under supervision. Information will be presented

using available audio-visual means, such as, movies, slides, surgical

specimens, visits to autopsy rooms, recorded lectures, etc.

Requirements for diploma: Doctor or Senior Medical Student who

have had previous training in radiology (Basic Course Radiology

Techniques) or equivalent experience.

Requirements for other participants not entitled to diploma:

Doctor, Medical Student or paramedical professional, for example

technician.

A certificate of participation may be issued in this category for

full attendance to lectures and

demonstrations but persons in this category

are not responsible to perform or render any special assigned work.

Capacity of enrollment for diploma - 8 trainees

Participants with no diploma - no stipends.

Stipends - A fee of \$25 will be charged to all enrollees to the

formal course with credit. Other participants no charge,

A program of the course is submitted:

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RADIOISOTOPES IN RENAL DISEASE

Program for the Special Advanced Course:

I. Introduction: Biophysics

Mathematical review

Lecture - 1 hour

Laboratory - 3 hours

2. Statistics review

Lecture - 1 hour

Laboratory - 3 hours

3. Review

Basic Concepts Nuclear Physics

Lecture - 1 hour

Invoratory ~ 3 hours

4, Review Nuclear Physics

Lecture = 1 hour

Labor tory ~ 3 hours

TL, Anatomic Pathology of the Kidney

5. Anatomy of the kidney: Eubryology

lecture - 1 hour

laboratory - 3 hours

6, Anatomie pathology of the kidney

lecture - 1 hour

Laboratory - 3 hours

7. Wistopathology of kidneys

lecture - 1 hour

laboratory ~ 3 hours

8, Renal Physiology and Clinical Laboratory

lecture - 1 howe

Laboratory - 3 hours

9. Renal Physio-pathology

Lecture ~ 1 hour

laboratory - 3 hours

---Page Break---

10, Spectral histo-pathologic techniques

(histo-chemistry)

lecture - 1 hour

Laboratory - 3 hours

TIT, Clinical Syndrome: Renal Diseases:

11. Nephritis and Nephrosis

Lecture - 1 hour

Laboratory ~ 3 hours

12, Metabolic diseases

lectures - 1 hour

laboratory ~ 3 hours

13, Vascular dte

lecture = 1 hour

Laboratory - 3 hours

1, Obstructive Uropathies including tumors and
infectious processes of the kidney

IV. Radiotopes

15. Renographic studies, part T

lecture - 1 hour

laboratory ~ 3 hours

16. Renographic Studies, part IT

lecture ~ 1 hour

Laboratory = 3 hours

17, Gamma Scintigraphy, part I

lecture - 1 hour

laboratory + 3 hours

18, Gamma Scintigraphy, part II

lecture ~ 1 hour

?aboratory - 3 hours

19. Electrolyte studies; Sodium turnover,

Sodium space and Sodium excretion

lecture - 1 hour

laboratory - 3 hours

---Page Break---

20, Fluid compartments - total body water

lecture - 1 hour

laboratory = 3 hours

21, Differential test of renal function using

stable sodium and radioactive sodium

lecture - 1 hour

Laboratory ~ 3 hours

22. Miscellaneous tests of renal function:

renal cystogram and radiocystometry,

excretion half time, renal clearance

and renal blood flow.

---Page Break---

ORIENTATION IN THE MEDICAL USES OF ISOTOPES FOR ONE WEEK DURATION

1, Introduction to basic concepts of Nuclear Physics and radioactive

protection, and handling radiotopes.

2, Radioactive applications in the study of thyroid glands:

3, Study of dynamic functions of the cardiovascular apparatus

renal and hepatobiliary eystem

4. Studies of gastrointestinal absorption.

5. Tumor Localization

6. Body spaces and fluid compartments:

acids,

electrolyte and fluid

7. Therapeutic applications.

Lecture time ~ 10 hours

Laboratory sessions - characterized mainly by

demonstrations, case presentations and

group discussions - 26 hours

---Page Break---

---Page Break---

?OUTLINE OF HATERTAL TO BU PRESENTED TO
ABC AD, HOC. COMMITEE FOR PROGRAM REVIEW

MEDICAL SCIENCES AID RADIOBIOLOGY DIVISION

Dr, Maurice Paul Weinbren, Head

?This division is composed of three theoretically separate programs,
?though, in fact, these have become interdependent in many ways. This
interdependence avoids unnecessary duplication of ekilie ant facilities
and has enabled the division as a whole, to operate with conelderably
greater efficiency. ?The basic program var established to:

8, To conduct craining and research in radioblology at the cellular
ant subcellular level with enphasia on medical applications.

?Bo establish and operate tissue culture facilities for its
fom program ani also to verve others.

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

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

In this area we have established a well-trained staff who are expert in most of the techniques of tissue culture. Little progress has been made with the program designed to study the effects on individual cells resulting from neutron capture by Boron 10, because not sooner did Dr. Samant's group succeed in synthesizing compounds containing Boron 10, than we lost our standard cell lines due to persistent and refractory contamination.

A program to study human chromosomes in cultured leucocytes was established as a cooperative effort between the US Army, Tropical Medicine Research Laboratories (Col. H. Dacqviste), the Division (Dr. J. Fy Weimbren) and the Division of Radiotherapy and Cancer (Dr. José Ton). The program is designed primarily to establish a normal pattern and to compare this with material from cages with "Tropical Spruce", Radiotherapy patients receiving radiation to the abdomen and in bone @

?sprue-like" condition results, and patients receiving similar doses of

radiation to areas excluding the abdomen, The study is not, however,

---Page Break---

Limited to this type of material and we have received a number of specimens

from physicians at the University Hospital and the forces. Our first cultures

were made on October 22, 1963 and we have now (September 14) processed 10

Wow that this facility has been established it is? proposed to

?a file of material from the members of the Puerto Rico nuclear

Center staff, and in particular to follow those individuals who were

accidentally exposed to radiation in Mayaguez.

?The Dengue Epidemic

?This Division was invited to participate in a study of the epidemic

of Dengue fever which was first recognized as being of epidemic proportions in the town of Manati in late August 1963. The part played by the Mesue Culture Unit was an attempt to isolate virus from 1/3 sera collected from patients in the first 12 hours of illness. The tissues used for this purpose were African Green Monkey (*Cercopithecus*) Kidney monolayers which were purchased in tubes from Flow Laboratories.

From 36 of the sera inoculated into the tissues a "positive reaction" was obtained. The term "reaction" has been used because as yet we have been unable to achieve the usual end point of specific cytopathogenic effect which is transmissible for an indefinite number of passages

In dengue culture two types of change were seen and may be referred to as "early" and "late". The early change consists of a fleeting cytopathogenic effect where areas of degeneration of the cell sheet occur and the affected cells detach and can be seen floating in the medium. This usually occurs on the 3rd. day following inoculation and would appear to be confined to a hypersusceptible cell population as the detached cells are replaced in a matter of hours by the cells not affected at this time. The "Late" phenomenon occurs between the 6th and 10th post inoculation days when the monolayer's appearance becomes that of Madeira Lace or drawn-thread needlework; there are "holes" of varying size up to 3004

in diameter separated by bands of cells piled several deep, At this stage there is little or no increase in the number of cells floating free in the medium but if the process is allowed to continue for a further 2 or 3 days all the cells detach.

In many instances both "early" and "Late" phenomena occur in the same cell sheet but this is not invariably the case. Sometimes, when the specimen was inoculated at different dilutions, the lower dosage resulted in only the "late" form while the more concentrated inoculum produced both types.

In some instances the effects are transmissible by means of the supernatant medium from the "early" stage and in others only from the "late". In any event after 2 or 3 passages the virus assumed a condition of latency and although demonstrable in the cells by means of the indirect fluorescent antibody technique, no overt manifestations of any type were

---Page Break---

Altogether 299 fluorescent antibody tests were carried out in this unit in the course of testing tissue culture cells or mouse brain impressions for the presence of the Dengue virus.

We have recently been able to obtain a supply of BHK (Baby Hamster Kidney) cells through the kindness of Dr. Michael Stegel of the Variety Children's Research Foundation, Miami. Dr. Siegel obtained this established diploid cell line from its originator, Dr. Stoker, in Scotland,

Our particular interest in these cells lies in the fact that they have

been shown to be unusually sensitive to the Dengue viruses and we hope to use them to further our study of the material collected during the Dengue epidemic. Another approach to the problem of unmasking the latent dengue virus has been to use irradiated infant mice as a medium. The mice received 300 or 600 rad. before inoculation. The system used was one of continuous passage in both irradiated and normal mice. On some occasions the virulence appeared to be enhanced but this effect was temporary though it is true that larger quantities of the virus may be demonstrated in the brains of the mice from the irradiated series by the indirect fluorescent antibody technique (I.F.A.). Up till now this I.F.A. technique has been carried out on impressions made from the cut surface of the brain being studied but

in the last few days we have received a cryostat microtome and will now be able to use tissue sections for the purpose and this should be much more

satisfactory,

The dosage of 300 or 400 rai was derived from an estimated LDs in the region of 650 rad (based on previous experience with rats), It was further assumed that the R.B.D. for baby mice of radiation from a 350 KVP "Maxitron" would be similar to that from Cobalt ⁶⁰, subsequent experiments have shown however that this is not so, at least for the units at the Puerto Rico Nuclear Center and the Oncological Hospital. The attached table shows the results of the experiments which may be summarized as follows

---Page Break---

=e

DATE 900 KVP_MAXITRON 08

LD, DEATHS-DAYS LD, | DEATHS~DAYS

50 50

T/K/64 (PRNC) 456 5-24 (PRNC) 912 bal4

B/11/64 (PRNC) 456 4a20 (PRC) 912 ue

8/28/64 (PRNC) 486 bend (Hosp) 920 ais

wos? 455 wea

In all cases the animals were observed for 3 weeks and

no deaths occurred after those noted abot

718

MAXITRON (PRNC) cof? (pane)

Doser # Time of

Dead Alive Death Dead Alive

2200 aso ° °

1000 18 as 1 Se8 Sea

800 aso ° 16

600 aso cats ° 4

400 o 8 ° 16

200 o 16 ° as

to ese >, 922

s/n

1600 wo 46 cy ° 8

800 woo 7-10 ° a4

oo o 1s ° as

200 ow ° as

LD, 456 F Lp, 912 F

MAK, PRNC

1800 woe s

200 wo ea

400 o ow

vp, 86

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Pog

&eoaa g

a4

gota

8 8

gaaec.

g

g 88

---Page Break---

---Page Break---

OUTLINE OF MATERIAL TO BE PRESENTED TO

AEC AD HOC COMMITTEE FOR PROGRAM REVIEW

RADIOTHERAPY AND CANCER DIVISION

Dr. Victor As Norcal, Head

A. SADIOTHEAPY RESIDENCY PROGRAM

1. Training Program

?The purpose of this program is the training of radi

second most common cause of death in the nation requires that radiation therapy be

Utilized of sometime in the diseate in over 50% of patients. Adequate radiation the=

ropy is best provided by properly trained specialists with full-time interest and dedico~

tion to this aspect of medicine. This program attempts to train academically and research

?oriented radiation therapists. The ultimate goal is to serve the concer patient better,

providing him with woll trained specialists end more efficient treatment methods .

The present program of training constitutes @ collaborative project between the

Puerto Rico Nuclear Center, the I. González Martínez Oncologic Hospital, and the University of Puerto Rico School of Medicine. The main objective of the Puerto Rico Nuclear Center and the University of Puerto Rico School of Medicine are training and research, and that of the Oncologic Hospital is the service to cancer patients; consequently, the efforts of these institutions complement each other.

The total training period lasts three years, but trainees are required to take on an additional fourth year of supervised practice before admission to the Board certification exams. The program enjoys full approval from the American College of Radiology

Trainees acquire a solid background in cancer through supervised work with new, follow-up, and hosp. They learn to diagnose the disease, determine the extent of the same, choose the appropriate treatment, and plan and conduct radiological therapy. Additional therapy experience is acquired by working with roentgen therapy machines of various voltages and teletherapy units, which include cobalt and cesium, and with the application of radioactive material such as:

radium, strontium, cobalt, and iridium

The present program permits trainees to become familiar with non-radiological cancer treatment methods, such as surgery and chemotherapy. In addition, they learn of cancer control activities in Puerto Rico, this includes the operation of a Central Cancer Registry, tumor clinic work, cancer detection, and public and professional

---Page Break---

Since July 1, 1964 some changes have been introduced in the curriculum that affect mainly the first year trainees. Radiotherapy trainees in the first year will be offered a course of cancer pathology for three months, a course in radiological physics for three months, and a course in radiobiology. In addition, they will take the

Basic Radioisotopes Techniques Course and will be given radioisotopes clinical training for two months. A lecture course in biostatistics and refresher conferences in biochemistry will be offered during the training period.

Latin-american trainees have faced three major obstacles in coming to receive long term radiotherapy training at American centers. These are: the certification from the Council on Foreign Medical Graduates of the American Medical Association, which is a prerequisite for training in approved residency programs, licensure by the State Board to practice medicine on a temporary basis, and adequate financing during the training period. Since the requirement of certification by the ECMFG was introduced, the number of trainees has decreased in all American centers.

8, SHORT TERM RADIOTHERAPY TRAINING

The short term radiotherapy trainees are those that come to the Division as observers for a period of a month or longer. As a rule they are experienced radiologists who want to become familiar with our program. This constitutes a less desirable type of training for Latin-americans in view of the fact that they do not acquire a solid basis in radiotherapy. Short term trainees face the following problems: not a rule they have permanent positions at home and cannot afford to leave their departments for long periods of time and they are older individuals who cannot afford to bring their families with them in view of the limited economic support they receive while away.

C. FOURTH YEAR MEDICAL STUDENTS TRAINING

The fourth year medical students have been offered a training period of one month in the Radiotherapy and Cancer Division on a voluntary basis. The students do not enjoy free time in their fourth year other than a month of vacation. During the

?vacation some students choose to come to the Rediotherapy Division to learn about
?cancer and radiation therapy .

D. RADIOTHERAPY TECHNICIANS COURSE

the operation

ions. Radiotherapy

ing for two years. Our Div

ing course that will be offered to « group of nurses from the

Oncologic Hospital and the Puerto Rico Nuclear Center beginning early in fiscal year

1964-65. The proposed course follows the pattern required by the American Bocrd of

Radiology; it consits of four hundred hours of didactic activities and over a thousand

hours of supervised experience.

---Page Break---

E, VISITING RADIOTHERAPISTS

Young radiotherapists from Latin America have been given the opportunity to work as visiting radiotherapists for periods of one year or longer. This has permitted them to become familiar with our program and has proved stimulating to our staff,

The research activities at the Radiotherapy and Cancer Division continue being of clinical nature in the majority of projects. As no laboratory facilities are available in the Division, we have to request the help of the Medical Sciences Division for such services. It is expected that when the animal house be finished, basic research facilities will be enhanced considerably.

The following projects are underway in the Division,

11. Evaluation of Radiation Response by Means of Exfoliative Cytology in Cases

with Cancer of the Cervix Treated with Radiation =

is a long term project which is being carried out at the Radiotherapy Division

with the objective of determining the value of exfoliative cytology as a prognostic factor in cases with carcinoma of the cervix treated with radiation. An initial analysis relates to patients with a minimum of two years follow-up who showed the presence of persistent tumor cells in the vaginal smear after irradiation. The significance of this finding and its relationship to tumor free survival has been determined.

2. Surgical Adjuvant Breast Project.

This is a national project with the objective of improving prognoses in patients with breast cancer treated with radical mastectomy with additional therapy. Postoperative irradiation of the lymph node areas, and systemic chemotherapy are being investigated. So far, 29 patients from the 1. GonzGlez Martinez Oncologic Hospital have been contributed to the study .

3. Study of the Incidence of Leukemia in Patients with Cervical Cancer Treated with Radon.

This is an intentional study with the objective of determining the risk of developing leukemia in patients who have been irradiated for cancer of the uterine cervix. As of the end of June 1964 all the collaborating institutions have contributed 33,000 persons-years to the study and 2 cases have developed leukemia. The expected number of leukemia cases based on normal population incidence would be 2 cases

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4

4. Study of Chromosome Changes in Patients Undergoing Radiation Therapy

The aim of this study is to determine chromosome changes in irradiated cancer patients that may have prognostic value. The samples are taken before, during, and after irradiation and the lymphocytes are separately cultured, the cultures are then treated with colchicine and the lymphocytes are spread and observed for chromosome abnormalities

5. Study of Fractionation of Weekly Doses in Cancer Patients Submitted to

This is a clinical study aimed at determining the optimal fractionation of weekly tumor doses in patients submitted to irradiation for cancer. Half of the patients at the Department are receiving the weekly tumor dose divided in three applications vs. five applications in the other half. Tumor effect, survival, and normal reactions are being observed. Six hundred and twenty two patients have been incorporated in this study.

6. Study of Optimal Tumor Dose in Radiation Therapy of Cancer of the Esophagus

This is a clinical study to determine the optimal radiation tumor dose in the treatment of cancer of the esophagus. Half of the cases have been treated with cobalt teletherapy doses of 5000r in 4 weeks vs. 6000r in 6 weeks in the other half. Disappearance of dysphagia and twelve month survival will be compared in each group. Fifty four cases have been included in the study.

7.. The Influence of Whole Body Irradiation in the Enzyme Activity of the

ae ey rei fn He Ere Aste of te

This is a project to determine changes in enzyme levels in the intestinal wall caused by radiation. Mice have been studied as to acid and alkaline phosphatase levels in the small intestine which has been divided in two equal halves. Acid phosphatase levels have been found equal in both halves, but alkaline phosphatase in the upper half is twice in amount of what is found in the lower half. Total irradiation of the animal, up to 500, 48 hrs. before the animal is killed, has shown no change in phosphatase levels. S.G.O.T. and S.G.P.T. levels will be investigated.

8. Controlled Study of the Split-Dose Technique in Radiotherapy of Cancer.

The purpose of this study is to compare the results obtained by means of the usual uninterrupted treatment (6000 in 6 weeks) vs similar dose given in two separate two weeks periods with a rest interval of two to three weeks halfway in the treatment (2000r in two weeks / 2 to 3 weeks rest / 3000r in 2 weeks). Only tumors measuring 5 cm or more (excluding pelvis and esophagus) are included in this study. Half of the cases in

---Page Break---

the study are being treated with the usual technique and the other half receives the split-dose technique. Results will be evaluated in terms of tumor regression, normal tissue reactions and curability. Fifty cases have been included.

9. Adenocarcinoma of the Cervix.

This is a retrospective clinical study which has as objective to corroborate the clinical impression that adenocarcinoma of the cervix uteri is more radioresistant than squamous cell carcinoma of this structure. Eventually we wish to determine whether the combined use of radical hysterectomy and radiation would improve the survival,

10. Carcinoma of the Cervix Uteri and Pregnancy .

10. Carcinoma of the Cervix Uteri and Pregnancy .

In this retrospective study the incidence of carcinoma of the cervix uteri associated with pregnancy was determined in a group of 2554 cases of uterine cancer reported at the 1. Gonzales Martnez Oncologic Hospital. Sixty two patients had their cancer associated with pregnancy. The optimal way of handling this complication has been determined from the reviewed material.

11, Carcinoma of the Cervix Uteri in Sterilized Women.

?Carcinome of the Cervix Uteri in Sterilized Women,

The aim of this study is to analyze

the cervix uteri and previous

the possible relationship of carcinoma of

of the reproductive capacity by surgical

sterilization. It has been observed that in patients under 50 years of age with carcinoma

of the cervix uteri 25.4% have had previous surgical sterilization. The true

significance of this finding is being evaluated.

Future Project

1. Combined Irradiation and Chemotherapy In the Treatment of Carcinoma of the Esophagus

This study has the objective of improving the curability of carcinoma of the esophagus by irradiation therapy adding methotrexate. The study will include controls and will be initiated during fiscal year 1964-65.

2. Study of Dose Fractionation and the Combination of Radiation and Chemical Agents on Mouse Tumor

Objective of this study is to observe the effects of various fractions of radiation alone or in combination with chemical agents on chondrosarcoma grown in mice. A correlation of radiation dose and histologic changes in the transplantable chondrosarcoma will be attempted.

---Page Break---

Available radiobiological and clinical data suggests that the response of anoxic
[upon it is best when the patients receive oxygen while being irradiated. The study
being suggested for discussion with the Advisory Committee Patients with bulky anoxic
be selected and half will be administered oxygen during radiation while the
other half receives identical dose of radiation but no oxygen. Tumor regression and
5-year curability will be evaluated.

WL. SERVICE ACTIVITIES

An adequate load of clinical cases is necessary for good training and for clinical
* research. As there exist hundreds of different types of cancerous tumors, the
must be exposed to a significant and varied load of patients to be able to become
with all types of neoplasia and the problems involved. Most clinical studies re-

quire @ good volume of cancer patients to be able to accumulate data of statistical significance

therapy and Cancer Division has not suffered from lack of good clinical
|, 5 it has access to all the patients seen at the Dr. 1. González Martínez Oncologic Hospital. During last year 21,794 teletherapy applications were given 20° eutietherapy insertions were made, and 723 new patients were registered for radiation treatment

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OUELINE OF MATERIAL TO BE PRESENTED AT
AEG REVIEW OF PENC PROGRAMS

October 15-17, 1964

REACTOR DIVISION

Presented by Mr. Héctor Barcelé

Head of Reactor Division

Punctions

?This program includes the operation and maintenance of a 1 megawatt

gvieming pool reactor and a 10 watt homogeneous reactor and the

elated equipment necessary to operate these facilities

Organization

1 Division Head

1 Reactor Supervisor

1 Associate Reactor Supervisor

4 Reactor Operators

1 Mechante

1 Janitor

1 Secretary

HLotory,

1. Operation

?The 10 watt homogeneous reactor was first made critical on

August 12, 1959.

The 1 megavatt swimming pool re

ctor was made critical for the

first time on August 16, 1960. The test period for this reactor

extended through November 1950, after which it was turned over to

the PRC for operation.

---Page Break---

-2-

Megawatt-hours of operation

Year 1951-1962 287.19 Megawatt-hours

Year 1962-1963, 996.76 Megawatt-hours

Year 1963-1964 1,163.67 Megawatt-hours

one term beam tube experiments

In July, 1962, the cesium tungsten experiment was inserted in the reactor in beam tube No. 2. In this experiment a graphite calorimeter

As used to measure the effects of radiation on graphite with respect

to Les entestvity.

In October, 1962, the first neutron spectroseter for the Neutron
Diefraction Program vas installed in beam tube No. 4 and the second
neutron spectroneter vas installed in bess tube No. 3 in July, 1963.

?Training

1959-1960 Training course given to four reactor operators for the PRNC

1961-1962 a. Training course given to twelve reactor operators for the

BONUS reactor

b, Shore course in instrument trouble diagnosis offe

two PENG electronic technicians

1962-1963 Reactor supervision training program given to six BONUS
supervisors

1963-1964 On-the-Job training of two reactor supervisors from Colombia,

South America

D. Improvements and developments

Beam tube No. 1 has been provided with a fast flux collimator and a borated-water neutron shutter

?The thermal column was improved to provide a higher and more uniform flux distribution over the vertical access opening.

?A new core configuration has been developed which provides a higher neutron flux density at the beam tubes and gives @ higher value of rod worth.

---Page Break---

10.

ne

-3-

Rod vibration caused by water flow has been reduced without the reduction in size of the water channels

?A mechanized system was installed to permit the transfer of radioactive material from the swimming pool into the hot cells under water.

A voltage regulator was designed and built by the reactor division for the safety amplifiers to correct rise in magnet current with power increase

[A Witrogen 16 detector was installed in the primary water outlet to monitor power level more accurately than is possible with the equipment for the differential temperature method originally installed

Aire scanner was built by the division to scan copper wires used for flux mapping

Techniques have been developed for constructing and overhauling rod magnets. One overhauled magnet has been in service for a period of four months with no indication of deterioration

An analog computer is under construction for the calibration of rods

Studies of C_6H_6 Liquid gamma-loop using toluene-benzene have been completed

A new instrument is being designed to enable the instrumentation

console to be checked without removal from the system

E. Publications and papers

1.

Presented by H. Barcelé at Gatlinburg, Tennessee:

PRN reports completed

4, Record Keeping - H. Barcelé

b). Hazards Summary Report for the I-77 Reactor - H. Barcelé and R. Brown

©. Operating Limits for the I-77 Reactor - H. Barcelé

4. Reactor Operating Procedures - H. Barcelé

(©, Reactor Operators Training Course (Academic Phase) - H. Barcelé

FINR reports in progress

48, Summary of the Hazards Report for the 1 Megawatt Reactor

D. Operating Limits for the 1 Megawatt Reactor

Papers presented at "Light Water Moderated Research Reactors" meeting*

74, Comparison of Rod Worth by Period and Analog Computer Methods

b, Elimination of Control Rod Vibration Caused by Water Flow

presented in June, 1962

---Page Break---

=a.

F. Engineering assistance to others

BOWUS reactor, Rincón

44. Calibration of ionization chambers for power reactor

b. Participation on BONUS Safety Committee

Participation as guest member on the Oak Ridge Reactor Safety Committee during 1963 for the inspection of OAR, LITR and X-10 reactors (H.Barcelo)

Control

Sugar mill operations in Puerto Rico - Development of production methods using radioisotopes

4. Control of crusher feed input for constant density instead of constant volume

D. Monitoring of feed to detect tramp iron?

fe. Interstage crusher output monitoring to improve crusher efficiency

G. Future plans for increase in megawatt-hour output

?The present operation of the 1 megawatt reactor is Limited to one shift (8 hours) per day at a maximum power level of 1 megawatt. It is expected

that in the near future the hours of operation and the power level of this

according to the following schedule:

reactor will be increased

1, Three-shift operation ~ 1 megawatt power level

2 megawatt power level

= 2 megawatt power level

= 5 megawatt power level

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OUTLINE OF MATERIAL TO BE PRESENTED TO

ABC AD HOC COMMITTEE FOR PROGRAM REVIEW

October 15-17, 1961

NUCLEAR SCIENCE AND TECHNOLOGY

Dr. Owen H. Wheeler, Head

A. EURATOM

Is teaching and research in Chemistry and Physics in support of

M.S. programs offered by the Departments of Chemistry and Physics of the

University of Puerto Rico in Mayaguez.

STARE

Scientists: Chemistry - O. H. Wheeler (1/2 time),

TF Facet

Physics - B. Ortiz (1/10 time), J. A. Gonzalo

Chemical Technology - J. Hufnot (Special Projects)

Research As

starts - Chemistry-2, Physics-1/2

Technical Assistants - Chemistry-2, Physics-L,

?Other-1

Graduate Students (PRIC) - Chemistry-2, Physics-2,

Pee

Future plans call for the addition of another physicist and another

research

stant in physics and an increase to 6 graduate student

?epointments.

Inter developments envisage increases to 3 chemists and 3 physicists

with a supporting group ratio of 2 assistants and 2 graduate students

per scientist.

---Page Break---

c. TEACHING

Me staff meabers of the Division teach courses in Chemistry and Physics directly related to Miclear Science (radiocheaistry, mclear physics) and other courses as a service to the University (statistical, mechanics, inorganic chenistry).

?The Division also organizes the weekly general seninars and special seninars in solid state physics and radiochenistry. ?The orientation of groups of visitors, including local high school stadents, on the

activities of the Center in Mayaguez, is also carried out by Division readers.

D. RESEARCH

Is offered for graduate students in the U.P.R., M.S. prograns in arch in these

chemistry and physics, and currently most of the research
programs is carried out through PRNC. In addition research for a Ph.D.
is available through the ORINS program. B. Cruz (Physics Dept.) is
a candidate for Ph.D. (Physics) at Harvard.

Staff members and visiting scientists also carry out independent
research.

5, RESEARCH FIELDS

Include radiochemistry, nuclear chemistry, hot-atom chemistry,
synthetic organic chemistry, physical organic chemistry, radiation
chemistry, chemical technology, solid state physics,

atomic physics,

radiation physics.

---Page Break---

Members of the Division, including graduate students, also cooperate with the Neutron Diffraction and Resonance in Radiation Effects programs.

The addition of research in neutron inelastic scattering and other

fields of neutron physics is expected in the future.

It is hoped to cooperate in these fields with newly established

groups in Colombia, Venezuela and Mexico.

P. RESEARCH ACTIVITIES

Cover the study of (i,q) reactions in heavy elements, range of fission products in aluminum, hot-atom chemistry of tin, antimony and bismuth compounds and of organic phosphorus compounds, mechanism of organic reactions using isotopic tracers, radiation induced brominations and hydroxylations of steroids, synthesis of steroids of radiological interest, use of ultrasonics in uranium extraction, chemical dosimetry, photomultiplier fatigue, radiation damage in ferroelectrics, radiation damage in alkali halide crystals and neutron diffraction study of magnetic structures.

PUBLICATIONS

During the last year 15 publications have appeared or have been accepted for publication in the following journals: Journal of Physics and chemistry of Solids, Journal of Inorganic and Nuclear Chemistry, Nuclear Science and Engineering, Bulletin of American Physical Society, Radiochimica Acta, Transactions of the American Nuclear Society, Journal of Organic Chemistry, Tetrahedron, Canadian Journal of Chemistry, International Journal of Applied Radiation and Isotopes, Zeitschrift fur Physik.

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A

GUTLINE OF MATERIAL TO BE PRESENTED TO
?ABC AD HOC COMMITTEE FOR REVIEW OF PRNC PROGRAMS

October 15-16-17, 1964

MUCLEAR ENGINEERING

Dr. José nis Garcfa de Quevedo, Head

Master's Degree Programs in Mayaguez in which PRNC Cooperates

?Trough Provision of Support, Laboratory and Research Facilities
and/or Teachers of Advanced Subjects

1. Nuclear Engineering

2. Health Physics

3. Biology

4. Chemistry

5. Physics

6. Agriculture

7. Mathematics

Master's Degree Program Requirements of ORING Fellowship in
Nuclear Science and Engineering (originally Nuclear Science and
Technology)

Original Organization of Nuclear Science and Technology Program
and Division Within the University and Within PRNC:

L. Use of sub-specialties under Nuclear Science and Technology
to cover all fields of graduate studies.

2. lack of direct academic cognizance over degree programs.

ew Organizational Structure

1, Direct cooperation with department with cognizance over general discipline involved, and with program orientation toward nuclear topics. (Biology, Chemistry, etc.)

2, Creation of new degree program and new academic department by the University to cover truly new discipline created by advent of nuclear energy ~ Department of Nuclear Engineering.

3. Creation of new PRIC division to meet engineering research and teaching requirements within PRIC - Division of Nuclear Engineering.

---Page Break---

a.

B, Division of Nuclear Engineering

1, Teaching responsibilities

48) cooperation with Department of Nuclear Engineering in supporting development of nuclear engineering degree.

1b) cooperation with other departments of the College of

Engineering in developing the nuclear aspects of their
disciplines

{2} electrical engineering

2) mechanical engineering

3) chemical engineering

b) civil engineering

cc) development of specialized terminal training programs to
serve requirements of ABC and Puerto Rico nuclear energy
development in the power and engineering areas. PEWRA is
now planning a reactor power plant per year for the next
ten years, starting 1970.

11) Reactor Operators Training

2) Reactor Supervisors Training

(3) Nuclear Engineering Training

(In this case, degree may be granted simultaneously
to academically qualified students through Nuclear
Engineering Department of the College. PRIC issues
certificates only.)

2, Research responsibilities

a) thesis research for graduate students in Engineering.

) engineering faculty research on educational and tutorial subjects.

c) open research and development in Engineering. (PRWRA is negotiating for combined electricity ~ desalination plant)

International

a) development of exchange teaching and research proposals with Latin-American engineering schools and laboratories.

b) development of residence training and research program at PRIC for Latin-American engineers.

ϕ) development of tutorial and training opportunities for engineers in Puerto Rico nuclear energy installations such as Bonus, PRVRA, etc.

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-3-

4) development of conference and institute activity in engineering pertaining to nuclear Energy development.

This will be based on:

(Q) special interest, facilities and capability at PRIC.

(2) aitto for Puerto? Rico

4, IABA Conference on Medium Size Reactor Power Plants.

February 1965.

, Participation in UPADI Conference in Caracas, 1954,

Son Juan, 1952. PRIC participants: Soderstrom,

Knight, Gonberg. (Also representing United States

Avoaie? Energy Commission and Energy Joint Council).

©. Projected Institute on the Bors Reactor Plant, for

Latin America and United States participants.

(3) support and development of activity in new areas.

a. Projected A.S.E.E. - C.D, Institute for Instructors

on Shelter Requirements (joint project with CAAM),

Present Status of Engin

and laboratory

writing Teaching Activity in Division

) students working toward M.S. - Current enrolment

(1) Boms trainees - 19

(2) tocar = 8

(3) Latin America

a, self or government - 1

bl TARA : 1

?TOTAL - 20

b) special trainees (Primarily Reactor Division)

(1) Reactor operator training - Sumer 1964

?a, Boms - 10

b. Local = 1.

ce. PRIC >.

TOTAL - 12

New group expected by January 1

(2) Reactor Supervisor training (nen are graduates of Nuclear Science and Technology progras) Two from Colombia.

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4

ø) special engineering research and study within Division and laboratory

(2) Riermal entssivity of graphite

{2) Neutron sonochromator based on total reflection

3) Nuclear afterheat in case of water loss - PRNC reactor

t) Development of Reactor Lab teaching mamial for ieee in Spanien

(5) Rework of sections - Hazards Summary Report

(6) Leaching of Uranium Gres with help of ULtrasonice

(7) Use of tracers in Cheaical Engineering Processes

a, Study of aixing

DI Determination of Particle velocity in Rotary Kilue

ce: Diffusion in Metallurgy

4) personnel of Miclear Engineering Division

Head: Dr. José tuis Garefa de Quevedo*, Ph.D., also

SRatiaan, Besariont ofF Misia fngtnecting,

Members: Dr. Donald 8. Sasscer*, Ph.D., Joa; Department
of Nechanicai Engineering.

Dr. Aviva B. Gilesdi (full tive starting

October 15, 1951).

Dr. Peter Paraskevoudakis (on loan frea Health

Physice Division).

Dr. Phillip W. Osborne; Departaent of Mechanical

Engineering Metallurgy.

Prof. Kenneth Soderstroa*; Department of Mechanical

Engineering.

Prof. Carlos V. Wheelers; Department of Mechanical Engineering.

F, laboratory Assistance in Nuclear Engineering to Others.

1. Bonus

4) Calibration of Ionization Chambers for Power Reactor

b) Participation on Boms Safety Coanittee:

Gonberg, Barce1é

FCAAM Faculty - Part Time PRKC

---Page Break---

=5-

ø) Construction of N.A.D. equipnent

(Other non-engineering services in health physics end operations area also supplied)

Sugar Mill Operations in Pierto Rico ~ Developaent in

Production Control using Radioisotopes.

a) Control of feed for constant weight input to crusher.

b) Foreign material detector for sugar mill feed Line.

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OUTLINE OF MATERIAL TO BE PRESENTED AT

ABC REVIEW OF PRNC PROGRAMS

October 15-17, 1964

eaLTH Paste

Presented by Dr. José A. Ferrer Monge, Ph. D.

Head of Health Physics Division

I, Health Physics Division

A, AEC Operating Requirements

B. Service and training objectives

TL. Services

AL Present services

Puerto Rico Nuclear Center

a, Personnel and area monitoring

D. Consulting

2. Environmental surveillance

4. Medical service

fe. Instrument calibration

£. Waste disposal

2, BONUS reactor at Rinesn

a. Film badge service

b. Environmental surveillance

fe. Consulting

Advising government agencies, private companies, and various

departments of the University of Puerto Rico in Health Physics

B. Future plans

1, Immediate completion of a disaster center for

dosages received in criticality incidents

termination of

2, Development and construction of instruments for calibration of

research equipment and for highly accurate dosimetry.

---Page Break---

mm.

Ww.

Béucation

A

current program

Special features of PRNC and its relationship to Latin America

2, Status of Health Physics in Latio America

3. Re-evaluation of the Atoate Energy Commission Fellowship program
in Health Physics

4. Degree program in Health Physics in cooperation with Biology
Department

5. cooperation with departments of physics, chentstry, and nuclear

Engineering to develop aspects of Health Physics ac related to
these flelde

3. Puture prograns {n education for Latin Anertes

1. Exchange coaching

2, Teatning in residence for Health Physicists from Latin Aneries

development of Health Physics conferences and institutes tn

Latin Anerican countries

ec. state

1. Perecenel for regular Health Physics program

Specialized personnel for advanced electives

Research

A, Areas of concentration

1, Interaction of radiation with matter

2, Medical aspects of Health Physics

3. Radiation protection and dosimetry

4, Radiation ecology

5, Radtohtology

Present programs

1. Eeologteal studies

2. Supervision of thesis research for graduate studente in Health

Physics

---Page Break---

©. Future plane

1. Cooperative programs with various laboratories in Latin Anertcan

2. Research programs for Health Physicists in residence from Latin

Averica

---Page Break---

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OUTLINE OF MATERIAL TO BE PRESENTED TO

?AD BOC COMMITTEE FOR PROGRAM REVIEW

October 15-17, 1964

Agricultural Bio-Sciences Division

T, Activities in Education and Training

Any Courses

given by ABS Division personnel in FY-1964

Ly Tn Mayogues,

1. Biology 617 = Advanced Genetics (Linden, 3 credits)

2. Biology 618 = Cytogenetics (Koo, 3 credits)

3. Biology 645 = Special Problems in Nuclear Biology
(Linden, 3 credits)

4. Biology 670 - Research Thesis (Koo, 4 credits)

5. Biology 690 = Graduate Seminar (Linden, 1 credit)

£. Biology 691 - Seminar in Radiobiology (staff, 1 credit)

2. In San Jun

2, Biology 372

Nuclear Techniques in Biological Research

(Luse, Roig, 4 credits)

D. Biochemistry 311 Seminar in Biochemistry and Nutrition

(Aretski, et al, 2 credits)

B, Masters degree thesis programs with (BS staff participation (in Mayaguez only). (Linden, Koo)

1. Supported by PRNC

a. Full-time assist

state who are taking one course per semester

5 in Biology

2 in Agriculture

2 in Chemistry

b, Part-time assistants who are working toward M.S. degree

2 An Biology

2. Thesis work at PRNC but no financial support given to student

College of Agriculture plans new program with 23 student:

10 of which wish to do thesis at PRNC.

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©. Special training, as part of research activities

1, Project - "Isotope Applications in Soils

given to IAEA Fellow (Luse)

2. Project ~ "Radiation Effects on Forest Structure? -

Ph.D. thesis by ORINS graduate Fellow (Luse, Odua)

3. Other Oak Ridge Graduate Fellowships and Research Participants

are potential trainees,

TL, Research Projects of 18S staff

Ay Utehin PRKE

1, Agorole Metabolism ~ Andrew Hor

2, Mechanism of Bock Mitation - Francis K.S. Koo

okt

3, Radiation and Chemical Effects in Plant Chromosomes -

Francis K-S. Koo and Edith fobles de Irtearry

4, Uptake of Sr and Ca by Sorghum vulgare and Pueraria hirsute

io Pure Stands and in Combination in Relation to the Relative

Concentration Of these Elements in the Soil Flavio Pedovani

under Joint supervision of Francis K.S, Koo and Frank +

5, Nuclear Volume and Radiosensitivity in Rain Forest Tree

irlearty

6. Biochemistry of Sugar Cane - Robert A. Luse

7. Element Cycling in the Tropical Rain Forest - Robert A. Luse and

Rosaed To us ots Peepcst Rein Forest

8. Insect Control by Induced Sterility - David Walker

9. Rearing, and Radiation studies of Diatres Secchorelis -

Dovid Watker? aod Adele V= de Tlenaty: sed Miguel Figueros

10, Trailing Indigo Project - Jean Gareto

AL. Service Irradiation with CoO - José Cuevas Rute

12, Tropical Fruit Irradiation - Duane B, Linden and Jot

Rote ee teadltion

Species -

Cuevas

---Page Break---

B. Tn cooperation with other orgontzations

1, U.P-R. Agricultural Experiment Station staff (Mayaguez and San
Jaen)

?Azeem - Comma Radiation in Plent Breeding

?Abrens de Leon - Gouna Radiation in Plant Breeding

Pennock - Gasma Radiation in Plant Breeding

Alexander - Tsotope applications

Roldaa - Tsotope opplications

2, U.PAR, College of Agriculture staff (ayaguer):

Gama radiation and isotope techniques

3, U.P.R. College of Medicine staff:

Enzyse character zation

4, U.S, Aray Tropical Research Medical Laboratory staff:

batoradtography

C. Publications, a= index of increasing productivity

1961 = Division established

1962 - 8

we - 3

1964 - 20 (4ncluding in press)

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---Page Break---

Participation of the Puerto Rico Nuclear Center in the Atomic

Bnergy Comission "Atoms at Work? exhibit progres in Latin America

Fausto J. Milos Ritedeneire, Director

?The Atomic Bergy Comission has assigned to the Puerto Rico Nuclear Center responsibility for conducting investigetions in the physical and ?Biological ectences as part of the nev program of ?Atoms at Work" exhibits in Latin America during the fiscel yesr 1965-1955. The program vill be inaugurated in San Salvador, EL Salvador, C. An. on Fepruary 25, 1965.

?Ae PRIC coordinator for the exhibitte, the author of this report was Anvited ty the ABC Division of Special Projects to visit H Salvador and Guatenale during the lest part of June, 196,

1s part of en advance tean.

Te group visited officitale of the Ministry of Agriculture of Si Salvador ?and the University of San Salvador, Information concerning the spectral needs and interests of El Salvador

guinea at this time and has been

used as a basis for selecting research and lecture topics for the exhibit.

?The progress of research to be performed at HI Salvador suggests the

Possibility of cooperation in the future between the University of EL

Salvador and the Puerto Rico Nuclear Center. A tentative followup program

to involve students of the University of San Salvador might carry on graduate

study at the University of Puerto Rico has been outlined.

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Activities of the PAC Scientist Lecturers and PANC

Coordinator at the ABC "Atoms At Work?" exhibit in San Salvador,

EL Salvador, Central America.

1) General Introductory Lectures

Person in Charge: Fausto J. Mufloz Ribadeneire

"The Nuclear, Sciences and the Liberal,

Professionals'

February 12, 1965 "Chemical Dosimetry of Gamma Radiation?"

February 18, 1965 "Use of Tracers in Unit Operations of

Chemical Engineering?

February 19, 1965 "Nuclear Radiation and Industrial Processes?"

2) Lectures on Entomology

Dr. David W. Walker

Title of Lectures

February 25, 1965 "Application of Radiation Effects on
Entomological studies?"

February 26, 1965 "Studies of Entomological Problems in
Sugar Cane in Puerto Rico"

"and Food Conservation Problems"

March 4,

"Preservation of Tropical Fruit"

March 5,

Gonna Radinvion at the FRAC?

4) Lectures on Red\ochemt etry

Person in Charge: Dr. Juan F. Pacetti

Dates m4

of Lectures

March 12, 1965 "ketivation Analysis

March 12, 1965 "Sztlard-Chelners Reactions"

---Page Break---

5) Lecture on Neutron ce

Person in Charge: Dr. Badte Ortiz

Date Title of Lecture

March 16, 1965 "Descriptive Experiments Using a
(afternoon) Neutron Source"

6) Lectures on Applied Mathonaticn in Engineering Problems

Person in Charge: Dr. Badte Ortiz

ate Title of Lecture

March 16, 1965 ?Boundary Value Problems?

(morning)

Merch 17, 1965 ?aransform Caleulus"

(attemvon)

Yar 18, 398 "Pinite Diference Applications"

March 19, 1965 ?Wetrices and Tensors?

(aornrng

n

Dr. Modesto Irtarte (Fover Authority of P. R.)

Title of Lecture

?Pactors to be Considered tn Beonics

of Mucleer Power Plants?

Maren 22, 1965 "The BONUS Reactor and the Nuclear

Pover Program in Puerto Rico?

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