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UNIVERSITY OF CALIFORNIA

Radiation Laboratory

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MONTHLY PROGRESS REPORT
NO. 114

September 15, 1952 to October 15, 1952

October 31, 1952

RESTRICTED DATA

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UNIVERSITY OF CALIFORNIA, RADIATION LABORATORY

September 15, 1952 to October 15, 1952

MONTHLY PROGRESS REPORT NO. 114*

October 31, 1952

1. BEVATRON
(A.E.C. Program No. 9500)

UNCLASSIFIED

Magnet

The magnet test without pole pieces is expected to be completed by November 7. The UCRL electrical engineer in charge, spent October 7, 8, and 9 in Pittsburg with the Westinghouse engineers in meetings to decide on changes in the magnet power supply to prevent load shifting between the paralleled generators or rectifiers on inversion. Testing of these changes started at the end of the period and indications were that the difficulties would be overcome.

Delivery to UCRL of the pole base plates should begin by the end of October and the pole tip plates by January 1, 1953. Ninety-eight percent of the steel had been delivered to the fabricator by October 1.

A 1/7th scale magnet model is being assembled. This model will be used to make a final and more accurate check on the pole tip outline than was possible with the 1/12th scale magnet model, and it is hoped to complete these measurements by November 1.

Vacuum System

The gasket trouble, which was delaying the vacuum testing of the transition tanks and the construction of the curved tank, has been corrected to a great extent by the improved bonding technique developed by the vendor. The first tangent tank should be received at UCRL by November 3 and installed in the east tangent area of the Bevatron by November 10.

Inflector

Mechanical design of the inflector has been started. The beam will be turned 40 degrees on an 18 foot radius requiring an electric field strength of 35.8 volts per centimeter. Adjustments for the radial position of the inflector exit, the height of the inflector and the angle of the beam from the horizontal plane will be provided. The section of the high voltage electrode one foot from the exit end will be separately powered to provide for adjustment of the angle of the beam in the horizontal plane.

SECRET

* Previous report UCRL-1965 (No. 113)

2. 184-INCH CYCLOTRON OPERATION (A.E.C. Program No. 5741) UNCLASSIFIED

The cyclotron was used for research experiments approximately 93 percent of the 492 hours that the crew was on duty. The time distribution was as follows:

Operation for customers	458.50 hours	93.2 percent
Electrical troubles	22.75	4.6
Mechanical troubles	3.75	0.8
Others	7.00	1.4
Totals	492.00 hours	100.0 percent

3. 60-INCH CYCLOTRON OPERATION (Operated by the University of California) UNCLASSIFIED

A pair of double-pole grid feelers were installed in the 60-inch cyclotron this month. The installation was completed in 16 hours and resulted in a marked improvement in all standard beams. The threshold for α-particles was lowered below the minimum power limit; internal D^2 beam was increased, at minimum power, from 190 μamps to 400 μamps.

Normal operation schedules have ensued with these feelers showing increased collimator ratios on targets where small areas are bombarded. Operation with C^{+6} ions nonetheless is down by a factor of four. At present the belief is that a 1 pole feeler configuration will help solve this difficulty.

4. SYNCHROTRON OPERATION (A.E.C. Program No. 5731) UNCLASSIFIED

The synchrotron ran successfully during this report period excepting for an eight-day shutdown. This shutdown was required in order to replace a vacuum sealing gasket between the quartz vacuum segments. This gasket had punctured and made the vacuum unusable.

Satisfactory operation had only been possible with some difficulty prior to the shutdown. This difficulty was the apparent high voltage required at the accelerating gap for carrying the particles to maximum energy. Attempts to increase the gap voltage resulted in breakdown. The gap was cleaned as best as was practical before disassembly was forced on us. This cleaning of the gap did not help.

When the magnet yoke was removed and the resonator quartz section was removed, numerous tests were made on it. It was thoroughly cleaned and some copper strapping repaired. Delta "f" q measurements were made, etc. The q seemed low, but only about 20 percent lower than the spare resonator. This same quartz resonator ran cooler when excited in air than did the spare resonator. For this reason the resonator that had been removed, cleaned, and repaired was reinstalled.

The same difficulty in getting the entire beam accelerated to final energy was experienced upon reassembly of the synchrotron. Attempts to improve oscillator efficiency including tuning and phasing adjustments produced small gains.

Immediately upon reassembly of the synchrotron, the beam was made available for physics research.

The operating statistics are as follows:

Operation for customers	185.4 hours	57.9 percent
Machine shutdown	56.0	17.5
Electrical and mechanical maintenance	37.2	11.6
Installation and adjustment	40.0	12.5
Other	1.3	.4
Totals	320.0 hours	100.0 percent

5. LINEAR ACCELERATOR AND VAN DE GRAAFF OPERATION (A.E.C. Program No. 5751) UNCLASSIFIED

The beam current coil operation ahead of the analyzing magnet has now been made independent of "exit electrons." This, in effect, also insures freedom from errors due to changes in tank rf level. A second electron magnet, used in conjunction with the existing electron magnet as an "electron trap" in the sense of the well known television ion traps, achieved this end. Further investigations of the energe range of the exit electrons will be carried out when the current coil pulse integration circuits are completed. These are in the process of development. The pulse integration will, as now planned, be achieved through the use of electronics which portray numbers proportional to pulse area. A 1/4 scale current coil assembly is nearing completion.

The rf monitor for the linear accelerator is being further reworked. Revised control ranges, and one percent resistors are to replace the present components in the multiple channel volt meter chassis. These changes were found necessary upon full channel operation.

The 200 megacycle phase measuring circuitry pertaining to the linear accelerator beam energy monitor and the Van de Graaff buncher control problems are still in the developmental stage.

Following are the operating statistics for these machines:

Running time	362 hours	87 percent
Repair	50	12
Maintenance	4	1
Totals	416 hours	100 percent

6. EXPERIMENTAL PHYSICS (A.E.C. Program No. 5211)

UNCLASSIFIED

Film Program

Comparison of Alpha Spectra of Be^8 Produced from Beta Decay of B^8 and Li^8. The hammer tracks of B^8 and Li^8 are readily identified among the high energy disintegration products of light nuclei (UCRL-1937). Both of these mirror nuclei beta decay into Be^8. It was considered of interest to determine whether or not the beta transitions took place to different levels in Be^8. The alpha particle spectra from Be^8 were measured in emulsion for each case and found to be identical.

External Meson Beam from Cyclotron. A study with plate detectors indicated that π^- mesons were emerging from the cyclotron with the direction and energies calculated. The anticipated flux was not found, but the calculation of the flux from the density of mesons found in the plates requires some assumptions which may not be justified.

Other Projects. The following additional projects are active, but no new results have been obtained: high energy electron processes; meson scattering; meson masses and energy balance in meson decay; analysis of high energy disintegration products; and development of emulsion techniques.

Cloud Chamber

Three runs were made at the 184-inch cyclotron using the high energy (270 Mev) neutron beam and the 22-inch pantograph cloud chamber. The beam was produced by using a lithium-deuteride target. The first experiment was concerned with neutron induced stars in helium, the second with neutron induced stars in oxygen. Because a fairly large number of mesons coming out of the oxygen stars was observed, a special run was made using three beam pulses per picture in order to get a number of events sufficient to yield an angular distribution. All the film is now in process of being read.

The reading of film is continuing on the high-energy n-p scattering experiment made in the ten-atmosphere cloud chamber.

Internal Momentum Distribution

Preparations have continued for replacing the 35 geiger tubes in the proton energy spectrometer with scintillation crystals. Thirty-five anthracene crystals 1/2 in. x 3/4 in. x 1-3/4 in. are being cut with the wire saw. A base for the photo tubes and an improved mounting for the scintillation telescope are being constructed. Preliminary tests with the scintillation counters indicate that it will be possible to count high energy protons without counting gamma rays and very low energy particles, by properly adjusting the phototube voltage. This should aid considerably in cutting down the accidental channel counts, which have been the limiting factor in previous runs.

The Pi-Minus Meson Beam at the 184-inch Cyclotron.

Orbits for the emergence of the negative pi mesons from a target placed in the circulating proton beam of the cyclotron were calculated by Barkas and Rankin who also detected the presence of the predicted mesons in photographic emulsion placed outside the cyclotron tank.

An investigation of the meson beam has now been made using scintillation counter telescope techniques. A four-fold coincidence system of stilbene crystals with photomultiplier tubes operating with 3×10^{-9} second resolution was successfully used in the intense radiation background on the cyclotron platform. Definition of the meson projectory along the computed orbit, range requirements, and time of flight requirements were all in satisfactory agreement with the calculated meson energies and projectories. It appears that meson flux densities as high as one meson cm^{-2} sec^{-1} Mev^{-1} may be available at suitable locations on the cyclotron platform.

Pair Spectrometer for Bremsstrahlung and Neutral Meson Studies.

Experimental tests of radiation background have indicated that it may be possible to operate the high energy photon pair spectrometer without the use of proportional counters to define counting gates within which the geiger coincidences may record themselves. For the purpose of eliminating the proportional counters and of generating the counting gates simply by sharply defined coincidences between geiger tubes from each bank, electronic components are being developed. This method of operation should eliminate the problem of the variation in efficiency of the proportional counter system over the region covered by the geiger tubes.

Detailed calculations of channel efficiency for the 180 degree arrangement of the pair spectrometer to be employed in the bremsstrahlung studies are in progress.

Charged Mesons Produced by High Energy Neutron Bombardment.

An experimental survey of the charged mesons produced by the 290 Mev neutron beam on beryllium and carbon has been recently completed. Meson detection and identification were made by a simultaneous measurement of the momentum, velocity, and range of the meson in carbon. The ratio of negative to positive pi mesons with kinetic energy of 70 ± 25 Mev was measured at 15 ± 5 degree intervals for laboratory angles (θ), ranging from 15 to 125 degrees. The ratio data was fitted by a linear function of the angle, using the method of least squares.

(1) Be target, $\pi^-/\pi^+ = (36 \pm 7) - (0.13 \pm 0.08)\,\theta$
(2) Carbon target, $\pi^-/\pi^+ = (27 \pm 4) - (0.18 \pm 0.03)\theta$

The ratio for carbon at 90° compares favorably with Brodner's[1] result of $\pi^-/\pi^+ = 12.6 \pm 1.5$ for mesons of 50-65 Mev energy range. Brodner's work seems to be the only earlier measurement of this type for neutron bombardment.

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[1] Brodner, Rankin, and O'Connell, Phys. Rev. 79, 720 (1950)

In addition to the ratio data, the relative angular distribution for the mesons was obtained. If it is assumed that a carbon nucleus is equivalent to three alpha particles and a beryllium nucleus is equivalent to two alpha particles plus a loosely bound neutron, then a subtraction of the negative mesons from C from the negative mesons from Be should represent a contribution proportional to the neutron-neutron interaction. Our data give a considerable contribution for this subtraction. The interpretation of the negative meson angular distribution in a center of mass system of the two interacting nucleons is complicated by the momentum distribution of the target neutron. The problem is interesting because it may allow a comparison of the neutron-neutron interaction with the more well known proton-proton interaction for meson production. The analysis of the problem is being continued.

Charged Particles from Heavy Elements.

Investigation of the energy spectrum of charged particles emitted in the bombardment of heavy elements with 32 Mev protons from the linear accelerator has been continued. Particles are allowed to stop in a sodium iodide crystal observed with a 5819 phototube. The energy spectra are obtained by running a pulse height analysis on the resulting electrical pulses. The nature of the particles is determined by comparing their ionization before being stopped, as measured by a proportional counter, with their energy. The proton energy spectrum from lead at 90 degrees to the incident beam has been obtained and verified using two different methods of pulse height analysis. This information will be reported at a meeting of the American Physical Society in the near future. Installation of the 24-inch remote controlled scattering chamber has been completed. This useful device operates quite satisfactorily.

Electric Excitation of Heavy Nuclei.

The 10 channel pulse height analyser has been repaired, checked, and seems to be reliable again. The counters have been redesigned to fit into the new linear accelerator scattering chamber. A start has been made on doing pulse height analysis by the logarithmic photographic method. It is hoped to compare the pulse heights recorded by the photographic and the electronic methods.

Investigation of Short Radioactivities.

A run was made with the linear accelerator using a teflon target with magnetic analysis of the resulting β rays in an effort to observe the reaction $F_{19}(p,2n)Ne^{18}$. An activity was found which decayed by positron emission with a half-life of 1.2 ± 0.2 seconds. It was demonstrated that relatively high energy protons are necessary to produce the observed activity and that it was not produced from carbon. The activity is tentatively assigned to Ne^{18}, and more runs are to be made to provide more positive identification and to measure the properties of the β ray spectrum.

Synchrotron Studies.

Because of a failure in the vacuum system of the synchrotron, the running time for experiments has not been so great as usual. In addition to cleaning out the resonator section and restoring it to operation, some work has been done on

getting the beam to come out in a long pulse centered around peak field. For some time the beam in the long pulse has been coming out over 2,000-3,000 μsec., but centered considerably earlier than peak field. Work on this problem is continuing.

During the period, two runs have been made to test out the π-μ detection equipment and the physical set-up of magnet etc. for the experiment on π^+ mesons from H and D at small angles. There is still difficulty in the detection system, which a run on the cyclotron may clear up. There may be some considerable difference in the liquid scintillators used here and the stilbene crystals used on the cyclotron.

Work has continued on the detection of photons and electrons for a Compton effect experiment. Some of the shielding has been worked out satisfactorily, though further improvement in the background is still necessary.

One run has been made in a search for evidence of the Compton effect on protons by the use of a cloud chamber. The cross section is very low so relatively few heavy particle tracks have been found.

7. THEORETICAL PHYSICS UNCLASSIFIED
(A.E.C. Program No. 5211)

The application of the Tomonaga intermediate coupling formalism to meson theories is being continued.

A brief study of the possibilities of a phenomenological description of nuclear many-body forces was initiated.

A study of internal pair conversion of negative pions in hydrogen is being continued.

The Schwinger methods are being studied for application to a detailed study of neutral pion decay.

A study of the problems of inflector design for the bevatron is being conducted.

A study of classical meson theory is in progress.

Various studies aimed at obtaining more detailed data on the strong-focusing principle (i.e., periodic alternation of the sign of the "restoring force constant" of a motion) in accelerator design are under way.

A preliminary investigation of the inelastic scattering of protons by nuclei is being made.

Work has been completed on a report concerning graphical methods for the construction of particle trajectories through plane magnetic fields.

An investigation of coulomb effects in pion production by alphas on carbon has been started.

The investigation of quantum corrections to the radiation of electrons in circular plane orbits is continuing.

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8. THE M.T.A. PROGRAM
(A.E.C. Program No. 9200)

Target Physics Research

Further experiments in preparation for accelerating and stripping He^3 particles in the 184-inch cyclotron have been carried out. With 4 percent He^3, the He^{3++} beam as measured on an internal probe and also as measured by an ionization chamber out through the external beam snout was 4 percent of the α-particle beam normally obtained with He^4 gas. This is regarded as probably optimum operation based upon the extensive He^4 experience. The magnitude of He^{3++} beam out the snout was approximately 2×10^{-12} ampere.

With the beam thus obtained the attenuation of He^{3++} particles in beryllium and uranium was studied by observing the decrease in transmitted current as a function of absorber thickness. These measurements clearly show the longer range stripped protons and deuterons which persist beyond the range of the He^{3++} particles. Analysis of these curves is now is progress in an effort to determine the total nuclear cross section and stripping cross sections of He^3.

During a 12 hour run, recovery of He^3 was complete within the probable error of measurement, which was about 1 percent.

Sparking Studies

Experiments continue on XC to determine which metals have the lowest sparking rates and also suffer least from spark damage. Inconel, which has previously been determined to be one of the best metals, has now been applied to the troublesome first gap on the Mark I accelerator. Although the method of fastening is rather poor, it has already given the best performance, by far, that has been had. Twenty million volts has been held repeatedly and values as high as 21-1/2 have been recorded.

Cavity Design

Cavity designs, along the lines previously reported in this section, have been discontinued by UCRL. The data and conclusions to be drawn from the previous work will be reported in detail in future Laboratory reports.

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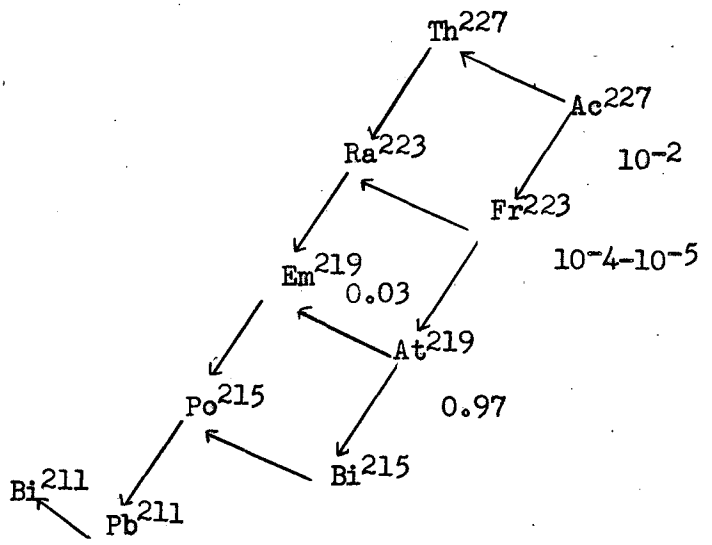
9. CHEMISTRY
Part A
(A.E.C. Program No. 5311)

Astatine in Nature

The occurrence of astatine in nature has been established by the discovery of At^{219} as a decay product of the actinium series. Astatine was separated by volatilization from Fr^{223} (AcK) which had been milked from a 40 mc source of Ac^{227}. The resulting sample was studied with the alpha pulse analyzer.

The decay sequence is: (numbers refer to branching fractions)



At^{219} has a half-life of about 0.8 min. and Bi^{215} about 8 min. From the branching ratios one sees that they occur as less than one part per million of the main line decay.

Radium Isotopes

Ra^{213} was produced by bombardment of lead with carbon ions in the 60-inch cyclotron. By fast work a sample of radium was separated chemically and delivered to the pulse analyzer with 1000 c/m of the alpha activity. The alpha energy is 6.56 Mev and the half-life 2.7 minutes. This is the first isotope of radium to be observed with less than 126 neutrons. These data agree satisfactorily with those predicted on the basis of the shell effect noted with bismuth, polonium, astatine, emanation, and francium.

Cesium Isotopes

Cs^{125} was produced by irradiation of calcium iodide with 100 Mev alpha particles. It was separated by the time-of-flight isotope separator. Decay measurements on the separated samples gave a half-life of about 45 minutes.

Xe^{125} (19 hour half-life) has been isolated as the daughter of this cesium activity.

Crystal Chemistry

Cerium carbides have been produced by reaction of cerium metal with graphite. CeC is face-centered cubic with the NaCl type structure with

$$a = 5.130 \pm 0.002 \text{ A.}$$

Another phase is body-centered cubic with

$$a = 8.455 \pm 0.008 \text{ A.}$$

It is identified as Ce_2C_3 because of its similarity of size and structure with Pu_2C_3 and Np_2C_3 which have been reported by Zachariasen. It is hoped to prepare Ce_2C_3 in a pure state in order to confirm its composition.

CHEMISTRY UNCLASSIFIED
Part B
(A.E.C. Program No. 5311)

Metals and High Temperature Thermodynamics

Work is in progress on the following problems:

1. Determination of the vapor pressure of tin.
2. Thermal conductivity of gases.
3. Gaseous molecules.
4. Gaseous oxides.
5. Refractories.

Basic Chemistry

The following problems are under investigation:

1. The hydrolytic polymerization of zirconium.
2. Thermodynamics of indium.
3. Heats of complexing.
4. Studies in non-aqueous solvents.
5. Thermodynamics of $S_2O_3^{=}$.
6. Rare earth fluorides.
7. Potential of the RuO_4^--RuO_4 couple.

CHEMISTRY UNCLASSIFIED
Part C
(A.E.C. Program No. 6400)

Organic chemistry, animal biochemistry, and plant biochemistry research has been continued during the past month.

Organic Chemistry

The work in organic chemistry has included (1) the isotope effect involved in the rearrangement of labeled pinacol, (2) studies leading toward the chemical degradation of ribulose and sedoheptulose, (3) research leading to the syntheses of morphine-7-C^{14} and codeine-7-C^{14}, and (4) investigation of the feasibility of preparing heptanoic-7-C^{14} acid by the reductive splitting of methyl-C^{14}-dihydroresorcinol.

Animal Biochemistry

In the field of animal biochemistry, research is in progress on (1) the effect of heparin on the rate of fatty acid metabolism, and (2) the role of Δ^7-cholestenol in atherosclerosis.

Plant Biochemistry

The research in plant biochemistry continues to be focused on studies of the metabolic processes involved in plant photosynthesis. Research in this field during the past month has included (1) separation of phosphorus-containing algae metabolites and measurement of the distribution of phosphorus radioactivity in these compounds, (2) studies on the radioactive constituents of ethanol distillates after the photosynthetic fixation of labeled carbon dioxide, (3) identification of sucrose phosphate in sugar beet leaves, (4) a search for photosynthetic intermediates, and (5) fundamental studies toward the improvement of paper-chromatographic techniques in photosynthesis work.

10. MEDICAL PHYSICS UNCLASSIFIED
Part A
(A.E.C. Program No. 6400)

Tracer Studies

Continuation of the studies in which a comparison of the radiation effects of α and β emitters is being conducted upon rats.

Investigations on the ability of Versene to chelate and change the metabolic pattern of curium in rats were continued.

Radioautography

Work is continuing on the autographs of the thyroid of the experimental astatine monkey.

An experiment has been started to further investigate the possibility of uptake of I^{131} by the stalk of the pituitary gland in Guinea Pigs.

Radiation Chemistry

A study of radiation induced reactions in aqueous systems has been continued. A preliminary paper has been prepared on the effects of high energy helium ion irradiation of acetic acid solution. Work has started on the effects of heavy particle radiation on aqueous glycine. Radiation studies of formic acid and oxalic acid are continuing.

MEDICAL PHYSICS
Part B
(A.E.C. Program No. 6400)

UNCLASSIFIED

Carbon^{14} Studies

Studies of the urinary excretion of glycine-2-C-14 in man show that approximately 12 percent of the C-14 is excreted via this route. Because urea is the major carbon containing constituent of the urine, consisting of approximately 90 percent of the urine carbon, studies were made in two patients of the relative excretion in the urine of C-14 as urea. These studies show that urea is not the major C-14 containing constituent; in fact only 20-40 percent of the urinary C-14 is in the form of urea. This indicates that other carbon containing constituents of the urine must contain C-14 and must have a specific activity considerably greater than that of urea. For this reason studies are being undertaken of the quantity of C-14 in urinary uric acid and carbonates.

Lipoprotein Studies

The parenteral administration of heparin to humans and experimental animals have previously been shown to result in the production *in vivo* of an active factor capable of producing marked serum lipoprotein transformations. In vitro studies of the mechanism of action of this active factor are now in progress and they indicate that at least one phase of the action of heparin active factor on lipoproteins may involve the liberation of fatty acid presumably through a lipolytic mechanism.

Blood Volume Studies

Because of the recent widespread use of the labelled cell dilution technique for blood volume determinations it was decided that a study of the normal variations in the blood volume of the rat as a function of age would be in order. Donor cells from rats previously injected with Fe-59 were used. Blood volumes were done in normal male rats of the Long-Evans strain from 1 to 300 days after birth. The blood volume per 100 grams body weight showed a continuous fall from one day after birth to a plateau level around 150 days of age. A fall in plasma volume per 100 grams body weight to a plateau level at about 150 days of age was also seen. The red cell volume per 100 grams body weight reflected the usual anemia shortly after birth (15-20 days) after which the red cell volume per 100 grams body weight remained relatively constant with the exception of a small drop after 200 days of age.

Biological Effects of Radiation Studied with the 184-inch Cyclotron

Dr. Ludwig von Sallmann of Columbia University completed a three months visit. We collaborated with him on a study of the etiology of the production of radiation-induced cataracts in rabbits. The 190 Mev deuteron and 380 Mev alpha particles were utilized for localized irradiation of one eye of each animal, while the other eye served as control. Cataract formation was studied after a single dose as a function of specific ionization. Also the equatorial and central regions of the eye were irradiated separately in an effort to find the most sensitive site of irradiation for cataract formation. A detailed report is in preparation.

A new series of experiments were carried out on the localized irradiation of the rat hypothalamus. Several months after irradiation, the rats treated in the anterior hypothalamus developed obesity, confirming previous data, while those which received the dose in the posterior part showed no similar signs. Work was commenced toward localized irradiation of the pituitary gland of monkeys with the deuteron beam.

Biological Effects of Radiation on Microorganisms

The irradiated diploid yeast cells were induced to sporulate immediately after irradiation and a number of viable haploid spores were subsequently isolated. This experiment is being performed in an effort to add further proof to the previously proposed theory for inhibition of cell division by radiation. According to this theory, preirradiated diploid cells can carry many heterozygous lethals. When the cells sporulate these lethals should become dominant in the haploid spores so that one is able to observe a number of spores which are unable to divide. Preliminary results confirm this hypothesis and indicate that the number of viable haploid spores decreases as the dose increases.

Work was started with a strain of Allomyces arbuscula which was received from Professor Ralph Emerson. These organisms can be obtained in haploid and diploid variety, and they have the advantage that the chromosome number is known and the chromosomes are large and easily stained. Preliminary data are available on the survival curve of a 16-chromosome strain of diploid spores and work is in progress on an 8-chromosome strain.

Instrumentation

Gamma Ray Radiography: The instrument in use at present has 10 sodium iodide crystals activated with thallium which are enclosed in a lead shield. The entire shield is movable and can scan over a patient. The impulses from the individual photomultiplier tube over each crystal are transferred to 10 neon bulbs and the flashes of these neon bulbs are recorded on a photographic plate. While scanning goes on, the neon lights also move in synchronism with the sodium iodide crystals.

One of the uses of this instrument was the finding of thyroid carcinoma metastases. So far five patients have been scanned over the entire body. In one case two new metastases were found which were previously not seen in diagnostic

x-ray pictures. In other cases which were previously surgically thyroid-ectomized some uptake was found in the region of the thyroid glands indicating incomplete removal of the gland.

Further work is in progress, particularly in the field of visualization of the liver and spleen with the use of radioactive gold colloids.

11. HEALTH CHEMISTRY (A.E.C. Program No. 5311)

UNCLASSIFIED

The Equipment Development Group has been engaged in work on the following items:

1. An improved cooling system and gun target design for use in the target assembly for bombarding large quantities of heavy alpha emitters in the 60-inch cyclotron have been completed.

2. Special equipment for work with the Beckmann spectrophotometer has been completed.

3. A large-volume cold bath with temperature control for use in americium purification was completed.

4. Regarding the equipment being readied for use in the 6-inch and 2-inch lead caves, in which bombardments from Idaho Falls will be processed, models have been built for eight items, including in part a chain drive manipulator, rotating reagent rack, remote control syringe, light cooler for use in the 6-inch cave, power panel for the 2-inch cave, "Bread board" base for equipment in the 2-inch cave (see Quarterly Progress Report for July-September 1952 for more complete description), and a hot and cold bath system under small hood for fume collecting. Nine other items have been designed, drawn and ordered in the shops, including a lead shield and dolly assembly, a dolly for use in the 6-inch cave, the chemistry box unit with trays and doors for use in the 6-inch cave (see Quarterly Report), centrifuge well for the 6-inch cave, improved doors for the 2-inch cave, 6-inch cave door opening mechanism, a second leadglass window panel on the 6-inch cave, etc.

5. A special table for use when the fission-rate counter setup was completed.

6. Maintenance and repair work was completed on the bombarded animal ash processing equipment.

7. Nine gloved boxes were assembled, fitted and delivered as per requests.

8. Requests for ten radioactive sources were received and fulfilled.

During the conversion of scrap normal uranium to oxide, in the area behind Bldg. 5, some sludge from one of the barrels was spilled on the roadway. The material was removed and the road decontaminated.

RESTRICTED

12. PLANT AND EQUIPMENT

Chemistry Laboratory Building. (Project No. 9500. 5-424-1002)

Nothing new has developed. The plans are expected to be completed the early part of December.

Synchrotron Research Building. (Project No. 9500. 5-424-2001)

The Synchrotron Research Building is approximately 25 percent completed and the basalt block walls are now being put up.

Bevatron Instrument. (Project No. 9500. 5-424-9001)

The magnet core has been erected and power supply testing is going on. The frame work and housing for the ion gun have been completed and approximately 90 percent of the prefabrication work has been done on the ion gun. Regarding the curve tank envelope, four tanks are to be made and the top of one has been completed.

Radiological Laboratory at the U. C. Medical Center. (Project No. 9600 6-424-9008)

This job is complete.

MAN-MONTHS EFFORT REPORT
Scientific Personnel

PROGRAM NO.	SUBDIVISION	MAN-MONTHS EFFORT	COMMENTS
9500 Bevatron	Miscellaneous	8.72	
Operations			
2000 M.T.A.	Design and Development	43.00	
3000 Weapons Research	General	60.42	
5211 Physics Research			
Experimental Physics	Cloud Chamber	15.37	
	General Physics Research	59.03	
	Instrument for General Use	5.39	
	Magnetic Measuring	3.53	
Theoretical Physics	General	15.39	
Photographic Film Detectors	General	16.28	
5261 Applied Physics Research			
Mark III Cyclotron	Electron and X-C Models	3.97	
Chemistry Research			
5311 Basic Chemistry Research, Part A	Chemistry of Heavy Elements	4.41	
	Nuclear properties of Heavy Element Isotopes	11.28	
	Transmutations with 184-inch and 60-inch Cyclotrons	7.90	
	Analytical and Services	21.82	
	Special Chemistry Development	.94	
	Mass Spectroscopy, Beta Ray Spectroscopy	2.25	
	Instrument Development and Services	4.42	
	X-Ray Crystallographic Measurements	3.21	
	Health Chemistry Research	7.58	
5311 Basic Chemistry Research Part B	Metals and High Temperature Thermodynamics) Basic Chemistry, including Metal Chelates) General	10.49	
5361 Applied Chemistry Research	Process Chemistry	6.26	

UCRL-2000
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MAN-MONTHS EFFORT REPORT
Scientific Personnel

PROGRAM NO.		SUBDIVISION	MAN-MONTHS EFFORT	COMMENTS
Reactor and Accelerator Operation				
5731	Electron Synchrotron	Operation	11.66	
5741	184-inch Cyclotron	Operation	10.88	
5751	Linear Accelerator	Operation	10.20	
Biology and Medicine				
6300	Biology and Medicine	Internal Irradiation and Hematological Response	6.94	1.32 Consultant Man-Months
		Health Medicine	.50	
6400	Biological Research	Instrumentation for Quantitative Measurements of Radiation	2.21	.40
		C^{14} Metabolism	2.98	.25
		Use of Radioactive Materials in Human Physiology and Experimental Medicine	12.36	3.09
		Trace Elements and Irradiation Studies	7.03	1.18
		Radiation and Mutation Rate	1.60	.25
		Physical Biochemistry	14.09	4.15
		Biochemical Response to Irradiation	4.72	.50
		Miscellaneous	5.04	4.75
		Metabolism of Lipo Protein and Lipids	5.05	13.55
		Iron Metabolism Hematopoiesis	2.77	.91
		Synthetic and Experimental Organic Chemistry	27.36	-
		Metabolism of Fission Products	17.57	-
6500	Biophysics Research	Biological Effects of Cosmic Radiation	3.05	.17
		Health Physics	2.16	-

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