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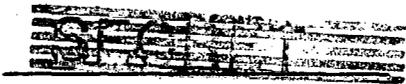
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MONTHLY PROGRESS REPORT
NO. 112

July 15, 1952 to August 15, 1952

September 8, 1952

SPECIAL REREVIEW
FINAL DETERMINATION
UNCLASSIFIED
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DATE: 3/28/80

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UCRL-1944

UNIVERSITY OF CALIFORNIA, RADIATION LABORATORY

July 15, 1952 to August 15, 1952

MONTHLY PROGRESS REPORT NO. 112*

September 8, 1952

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

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Magnet

The magnet tests without pole pieces are proceeding. Full power from each of the two motor-generators has been connected to the magnet, and parallel operation of the motor-generators has been tried. Some of the problems being worked on are: reduction of the magnet voltage ripple; adjustment of controls to balance the load on each generator when operating in parallel; elimination of erratic sparking between magnet core laminations. This sparking is of low energy, occurs at the higher power levels, and sometimes disappears after several hours of operations.

Working drawings of the pole tips have been revised to show the shaped profile for obtaining the maximum useful width of field as determined by the magnet model tests. Fabrication of the pole base die is expected to be completed by October 1 and the pole tip die by November 1. Drawings of the pole tip stanchions have been revised to accommodate the shaped pole tips. The latest samples of the nickel cast-iron material for the pole tip stanchions were found to have a magnetic permeability of about 1.04, which is satisfactory. A pole base filler (to support the vacuum tank in the area left unsupported by the smaller pole bases) has been designed and is being ordered.

Vacuum System

Two of the eight transition tanks, which fit between the straight and curved tanks, have been received at UCRL, and one is being vacuum tested.

Injector

The glyptal on the interior surfaces of the linac tank will be removed by sandblasting, and the temporary vacuum pumping system will be replaced by the permanent system which has a higher pumping speed in order to obtain a better vacuum.

* Previous report UCRL-1904 (No. 111)

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

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The cyclotron was used for research experiments approximately 90 percent of the 515 hours that the crew was on duty. The time distribution was as follows:

Operation for customers	464.75 hours	90.3 percent
Electrical trouble	5.75	1.1
Mechanical trouble	40.00	7.8
Routine maintenance	2.75	0.5
Other	2.00	0.3
Totals	<u>515.25</u> hours	<u>100.0</u> percent

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

UNCLASSIFIED

A considerable amount of work was done during this month to develop a probe target which would withstand the full internal beam. To date a maximum of 300 μ a has been held. Casualties of the target caused water to be admitted to the tank, which consumed considerable time in pumping down the machine. The total productive bombardment time was thus cut by about one-third of the usual time.

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

UNCLASSIFIED

Although the synchrotron produced a good usable beam during this report period, it was very unstable in intensity. Fading and recovery of the beam intensity indicated the possibility of electrical charges building up inside the vacuum chamber. Two attempts to recoat the inside of the vacuum chamber were unsuccessful because they did not correct the fading phenomenon.

Finally two synthetic sponges were cut to contour so as to fit tightly inside the vacuum chamber. These sponges were tied together, one behind the other, dampened with air drying silver paint, and pulled several times through the vacuum donut. The sponges did not react normally when wet with silver paint and amyl acetate thinner, i.e., they did not swell or recover when squeezed as they would when wet with water. In order to make the sponges swell, they were initially wet with water, squeezed and then wet with silver paint and amyl acetate solvent. This operation with the sponges was successful, and the fading of the beam intensity was eliminated. The beam intensity was much better, also, and reached new records for Berkeley synchrotron operation.

The operating statistics are as follows:

Total crew time	436.0 hours	
Total operating time	367.5	84.3 percent
Total non-operating time	68.5	15.7
Beam time available	359.5 hours	82.5 percent
Beam time used	259.2	59.5

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

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A small scale model of the beam monitor current coil is being constructed. Also, a beam phase-measuring device is being developed in an attempt to measure phase relations between the beam and the rf voltage in the tank. Development is completed on the signal amplifier for the rf monitoring system, and construction is underway.

The linear accelerator was used for experimental work during approximately 81 percent of the 368 hours the crew was on duty. The operating statistics are as follows:

Operation for customers	296 hours	81 percent
Maintenance	4	1
Repairs	<u>68</u>	<u>18</u>
Totals	368 hours	100 percent

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

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Film Program

Disintegration of B⁸. "Hammer" tracks of B⁸ have been identified. The energy distribution of the alpha particles of Be⁸ arising from the beta decay of B⁸ has been determined. The same type of study has been made simultaneously of the hammer tracks from Li⁸. It is found that with the present statistics the distributions are indistinguishable, indicating that the two beta decays are true mirror processes.

Test of Charge Symmetry Hypothesis. The present result for the +/- ratio in the production of 15 Mev mesons when carbon is bombarded by alpha particles is 0.7 ± 0.2. This result is sufficiently near unity that support is given to the charge symmetry hypothesis, particularly since it is known that the coulomb effect on the ratio will tend to depress it somewhat.

Cloud Chamber

The wiring from the 540-kilowatt generator in Building 6 to Building 10 has been completed and preparations are made for the run to be done at the Linear Accelerator. The experiment will use a 16-inch expansion cloud chamber and will look for elastic and inelastic scattering from 32 Mev protons in Helium.

The four foot by eight foot diffusion cloud chamber is being assembled and tested in preparation for examination of extensive showers induced by cosmic rays.

Some of the parts of the 35 atmosphere diffusion cloud chamber are coming out of the shop and are ready for testing. A mold has been constructed

for casting windows from Actrolite R-250 plastic which has good optical properties and is comparatively resistant to solvents and surface abrasion. These windows have to withstand the high pressures and low temperatures involved in the operation of this chamber.

Positron Annihilation in Flight.

The positron annihilation in flight experiment was continued during a day and a half run on the synchrotron. The object was to try to observe the materialization of a high energy gamma ray in coincidence with the disappearance of a 200 Mev positron in flight. This objective was attained.

The disappearance or annihilation of the positrons in beryllium was observed essentially the same as before: namely, three counters in coincidence proved the presence of a high energy positron, while a fourth counter monitored its passage through the absorber. However, instead of determining disappearances by the difference between two large coincidence rates (triples minus quadruples), an anticoincidence circuit was used which gave the disappearance directly. The anticoincidence pulse was then used in coincidence with a fifth counter. This fifth counter could be placed in two general positions: (1) the extrapolated positron trajectory in the magnetic field. (2) the extrapolated gamma ray trajectory (namely, the tangent to the positron trajectory at the point of the absorber). With the counter in position (1), an efficiency for counting 200 Mev positrons directly by taking triples + counter five/ triples was 70 percent. This efficiency dropped to less than 1 percent when the counter was moved to position (2), saying that position (2) was essentially outside the positron orbit. With counter five in position (2) in coincidence with the anticoincidence disappearance pulse, i.e., with counter five looking at the gamma ray trajectory in coincidence with annihilations, showed a counting rate anticoincidence + counter five/anticoincidence \leq 5 percent. Counter five is a thin wall counter, and should not detect high energy gamma rays alone. Now 2-1/2 radiation lengths of lead, or 1.25 cm, (the maximum of the shower curve for 200 Mev gamma rays) was put in front of counter five in position (2). Then anticoincidence + counter five/anticoincidence = (50 ± 8) percent. This says that with counter five made sensitive to gamma rays a pulse is seen in coincidence with the positron annihilation. When electrons were used, these ratios were essentially the same except that the disappearance rate for electrons was one-fourth that of positrons. The disappearance of electrons is due to high energy bremsstrahlung, with residual short range in the beryllium absorber. These facts support the concept of positron annihilation in flight giving rise to at least one high energy gamma ray.

$p + p \rightarrow d + \pi$ Cross Section

A measurement of the differential cross section for the reaction $p + p \rightarrow d + \pi$ has been made at 60° in the center of mass system. The incident beam energy was approximately 335 Mev.

The meson and deuteron were measured in coincidence and were identified by velocity and range measurements. Calculations of the corrections are now in progress.

Proton-Proton Scattering at Reduced Energies (160 to 250 Mev)

The last run at the cyclotron showed a serious flaw in the method for this experiment. There are some protons scattered toward the counter telescope from the inside walls of the collimator. It has now been definitely found that these protons include a sufficient fraction of very low energy protons (less than about 30 Mev) that they are quite appreciably attenuated in the liquid hydrogen. This attenuation tends to bias the results seriously when alternate counts are taken with the liquid hydrogen filled target and dummy empty target. The background is in effect decreased when the liquid hydrogen is present, and the cross section obtained is too low. Serious consideration is being given to a plan to use magnetic analysis on the beam subsequent to its energy degradation in the lithium or beryllium absorbers. Not much sacrifice of intensity is necessary to do this. However, it seems difficult to be sure on paper how much one can improve the beam conditions by such a step.

Total Proton-Proton Scattering Cross Section (345 Mev)

The flask which was to contain the liquid hydrogen has been destroyed. It was accidentally evacuated during leak tests and collapsed under the atmospheric pressure, as would be expected for such a vessel. A new vessel is being made.

Elastic Proton-Deuteron Scattering (Using 345 Mev Protons)

Equipment is still being built and tested which should enable a positive identification of the deuterons from the elastic scattering process. Both a proportional counter and scintillation counters are being constructed and studied in this connection.

The usual distributed amplifier counting equipment is being somewhat reworked in an effort to make it more reliable.

Cerenkov Counter

A Cerenkov counter consisting of a 5819 Photomultiplier viewing a liquid chamber two inches diameter times four inches has been constructed. In a test using a water medium and cosmic ray source, the following results were obtained:

1. For phototube voltages of 800-850 volts the forward to backward counting rate was $\sim 10:1$. Above that voltage tube noise decreases this ratio.
2. There was no plateau but counting rate increases rapidly with the high voltage.
3. At a voltage of 825 volts the (forward - backward) counting rate was 1.039 ± 0.108 counts per minute. This compares well with the 0.850 counts per minute calculated from the geometry and known cosmic ray intensities.

A great deal of the difficulty involved in the present attempts to use 5819 tubes in Cerenkov counters is that the pulse heights of signal pulses are not materially greater than those of tube noise pulses. In Cerenkov radiation the numerical distribution of photons is constant with respect to frequency. Because the spectral response of the photocathode is limited, most of the radiation is not seen by the phototube. It is possible that the injection of a fluorescing substance into the medium of the counter will increase the pulse height somewhat by shifting ultraviolet radiation into the visible region. Diphenyl-hexatriene is such a substance whose emission spectrum corresponds to the sensitivity of the 5819. Kallmann reports a 40 percent increase in total intensity upon addition of minute amounts of diphenyl-hexatriene to a solution of terphenyl in phenylcyclohexane. Di-phenyl-hexatriene is not soluble in water but is soluble in ethyl alcohol. The alcohol index of refraction is 1.36 compared to 1.33 for H_2O . Experiments are under way to check the utility of fluorescence in increasing pulse heights.

Internal Momentum Distribution in Light Nuclei

A method of uniquely determining the internal momentum distribution of nucleus in light nuclei has been mentioned earlier in these reports. It involves detecting two protons coming off at 90° to each other from a collision of a high energy proton with a nucleus and energy analyzing one of the resulting protons. A preliminary experiment has been performed using 340 Mev protons on C and CH_2 and using a magnetic particle spectrometer to energy analyze one proton and a scintillation telescope to collect the second proton. A peak in the energy spectrum from CH_2 was observed at the proper place to be from the hydrogen but the background counting rate was too high to obtain good spectra. It is now proposed to use either scintillation or proportional counters instead of GM counters in connection with the magnetic particle spectrometer to overcome this background.

Nuclear Elastic and Inelastic Scattering of 300 Mev Neutrons

The present phase of the experiment on nuclear elastic and inelastic scattering of 300 Mev neutrons from C, Al, Cu, and Pb has been concluded. The details and results of the experiment are available in the UCRL Report 1938.

The Triton Reaction ($p + d \rightarrow \pi^0 + t$)

The differential cross section in the center-of-mass system was obtained at the pion angles of 90° , 110° , 130° , 150° ; these results seem to disagree with the $\cos^2 \theta$ -type distribution predicted theoretically. Plans are being made for another run to obtain the cross section at the forward angles, and improve the statistics at the backward angles.

Synchrotron Studies

During this period the synchrotron operated well, the only difficulty being a fading of the beam. In spite of this, the total radiation delivered was satisfactory.

The studies of photo-protons were completed. The results are included in a thesis by Rosengren (UCRL-1913) and will soon be submitted to the Physical Review. The measurements of the energy and angular distributions show fair agreement with Levinger's theory of the photoeffect involving quasi-deuterons. The yield of photoprotons (70 Mev and higher) is directly proportional to Z . The yield at 90° as a function of proton energy from carbon falls off about as $E^{-1.7}$ up to around 140 Mev; from that energy on it falls off faster. At 45° to the beam there is also a change of slope at around 140 Mev. If the photo-disintegration of quasi-deuterons were entirely responsible below this energy, one would expect this change of slope to occur at different proton energies (perhaps 30 - 40 Mev different) at the two angles.

The experiment on the yield of π^0 from H_2 and D_2 has been completed. The data have not been analyzed as yet.

Work has nearly been completed on a report "The Radiofrequency Fine Structure of the Photon Beam from the Berkeley Synchrotron". It is shown that the photon beam is emitted in pulses, corresponding in frequency to the frequency of rotation of electrons in the orbit. This indicates that the bunches consist of electrons whose maximum azimuthal phase oscillation is less than about 1 radian.

A run has been made to look at 135° to the beam at single high energy γ -rays. The γ -rays produced pairs, each number of which was counted in a telescope. The minimum energy γ -ray detected was about 15 Mev. The purpose was to see whether the yield of such γ -rays, which presumably arise from π^0 decay, varied with A in the same way as did the yield of γ -ray pairs detected by Steinberger, Steller, and Panofsky. The apparatus gave no yield at 165 Mev, which is close to threshold for π^0 production. At 300 Mev maximum energy, the yield per nucleon from Li to Pb fell off in the same way as found by Steinberger, Steller, and Panofsky, from about 1.28 for Li to about 0.3 at Pb. It seems that all the high energy γ -rays coming from a target arise in the process of π^0 decay.

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

UNCLASSIFIED

An investigation has been made of the extraction of the potential from the scattering matrix for nucleon-nucleon scattering according to pseudoscalar meson theory.

A preliminary study of possible selection rules and models to explain the apparently very small π^- production cross section for neutrons on protons has been carried out.

Work is continuing on the problem of a charged scalar meson field with a single nucleon source using an approximation not involving an expansion in powers of the coupling constant.

Work on the high energy photodisintegration of the deuteron is continuing. The connection with the low energy cross section is being studied.

A comprehensive set of curves appropriate to present bevatron design parameters has been prepared for the guidance of the bevatron staff.

A simplified model of a relativistic two body problem is being investigated. The intention is to obtain solutions which would exhibit more clearly the physical meaning of the concepts of relative time and relative energy which one encounters in problems of this type.

A study of the neutron-electron interaction has been put in final form and submitted to the Physical Review.

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

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A-12 Target Development

The base case design represents a water moderated and water cooled system for the production of plutonium. All detailed problems have been satisfactorily solved and it is believed that a machine can be constructed with a high degree of mechanical success. Heretofore, it had been planned to remove the C frames from the vacuum vessel to a service area for handling the fuel rods. At present there is consideration being given to arrangements permitting the removal and replenishment of the fuel elements while the frames remain fixed around the vacuum vessel. The possible use of fuel in the form of spheres instead of cylinders appears to offer advantages in this connection.

Gas cooled targets have been investigated. In particular, a helium cooled beryllium primary target and a helium cooled uranium secondary target. Both of these arrangements appear feasible but several severe handling difficulties need to be overcome. The main problem is the procurement of sufficient experimental data to optimize these targets. Consideration has also been given to a deuterium-beryllium primary target, as well as to an all beryllium primary and secondary target combination. Substantial additional optimization work will have to be done to ascertain how much further the fuel inventory can be reduced and the production rate raised.

Calorimetric Measurement of the Heat Evolved in a Deuteron Beam

Preliminary measurements have been made of the heat evolved by a deuteron beam on a uranium target using a calorimeter. The calorimeter remained in the path of the beam for 56 minutes, at which time the temperature of the target had risen 23.2° F, which is a rise of 1° F per 2.4 minutes. The temperature rise was observed with two, five element thermocouples in the target. About 1 BTU was delivered to the target. The beam had an intensity of about 7×10^{-10} amp. as determined by ion chamber methods. The current determined by counting monitoring foils showed 1.8×10^{-9} amp. Although calculations of Mev per particle have not been made, the results do show that the temperature rise of a beam target can be measured.

Radiation Experiments

The design of probes for use in radiation damage studies in the Mark I accelerator is essentially complete. A window rupture mock-up test showed that the thin metal windows in the design have a strength of about 100 pounds per square inch. The design calls for 25 pounds per square inch. The probe consists of a water-cooled thimble enclosing an array of thin specimens which are penetrated by the beam after it has passed through the window. These specimens are cooled by a high velocity stream of helium. The aerodynamic mock-up of this system has been fabricated for the investigation of any sample fluttering problems that may appear.

The cyclotron corrosion testing apparatus is nearly fabricated in the LRL shops. Aluminum and zirconium will be tested when the fabrication is complete.

The hot cells for post irradiation measurements are now being constructed at Livermore and apparatus and processes for remote measurements are being developed. The problem receiving attention is that of metallographic polishing of hot specimens. Electrolytic polishing is particularly desirable as far as contamination control is concerned. Presently, development of the technique for applying this type of polishing to metals is underway.

Calculations have been made of expected service lives of various materials. The electric cables leading to the drift tubes in the A-12 accelerator will be exposed to dosages too high for the use of organic insulators. Materials such as glass and asbestos or magnesium oxides have been recommended.

Present plans call for a simulated service fuel plate irradiation test to be carried out. A zirconium clad uranium-zirconium alloy plate will be irradiated in the Material Testing Reactor in Idaho. The thermal neutrons will produce fissions at the same rate as they will be produced in the A-12 primary by fast neutrons, thermal neutrons and deuterons combined. Exposure will be for one percent burn up of all atoms by fission. The plates will be fabricated by CRD people at Oak Ridge. It is expected they will be available for irradiation sometime during September.

Studies of Beam Profile

A necessary condition for the beam profile to be invariant with distance is that the particles be uniformly distributed in phase of radial oscillations. Studies of a large number of specific particle trajectories made with the UCRL differential analyzer indicate that the distribution is not uniform. This theoretical conclusion has been more recently confirmed with observations with the electron model. Both sources of qualitative information indicate that non-uniformities are pronounced but qualitative information is not available. These facts now lead to the conclusion that the peak to average intensity of the beam will be a function of target location.

Ways of measuring distribution in phase of the Mark I beam with the object of providing a more rational basis for location of the target are presently under consideration.

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

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Decay of At²¹¹

The radiations of At²¹¹ are being reinvestigated. No gamma rays are observed, so the electron capture decay seems to be to the ground state of Po²¹¹. From the x-ray intensities and estimates of the Auger coefficients, the ratio of K to L capture is 9.

The alpha particles from At²¹¹, measured on the magnetic spectrograph (calibrated against Po²¹⁸ and Em²²²) are found to have energy 5.862 ± 0.008 Mev.

Gamma Rays of Am²⁴¹

A previous study of the radiations of Am²⁴¹ with the bent crystal spectrometer showed 26, 33, and 60 kev gamma rays. Recent work shows that the intensity of the 33 kev gamma ray is diminished by careful chemical purification. The best explanation of its source is that the 60 kev gamma rays from Am²⁴¹ induce x-rays of lanthanum by the photoelectric effect. Lanthanum is known to be a substantial impurity in the americium which showed the 33 kev radiation. Further experiments are in progress to check this explanation.

Decay of Cm²⁴³

The magnetic spectrograph has revealed an alpha group at 6.01 Mev in a mixture of Cm²⁴², Cm²⁴³, and Cm²⁴⁴. It is the energy expected for the ground state decay of Cm²⁴³, and favors Am²⁴³ being beta stable.

Uranium X-rays

The energies of L x-rays of uranium resulting from internal conversion subsequent to alpha decay of Pu²³⁸ have been measured with the bent crystal spectrometer. They are in agreement with the values found for Pa²³³ beta decay, and the discrepancy with the accepted values from uranium excitation remain.

Mass Spectroscopy

The new time-of-flight mass spectrometer, adapted for collection of samples, is now in operation. A defective oscillator crystal was found to be the most serious cause of instability. There is still some difficulty with collection of charge on the walls of the drift tube. A bombardment type source has been installed and seems to work satisfactorily.

Crystal Chemistry of Thorium Oxalate

Work is in progress on the crystal chemistry of thorium oxalate. A hydrate (Th(C₂O₄)₂·6H₂O?) is produced by precipitation, and powder patterns have been obtained. Slow precipitation and digestion from hot acid solution yielded excellent crystals, but of a different structure. The analyses have not been very reproducible, but correspond approximately to Th₂O(C₂O₄)₃·xH₂O with x of the order of 6. Single crystal x-ray studies are in progress.

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

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

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

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The activities of the Bio-organic Chemistry Group continue to involve studies under three major classifications of plant biochemistry, animal biochemistry and organic chemistry.

In the field of plant biochemistry, fundamental studies on the nature of the process of plant photosynthesis have continued. This work includes the following subdivisions: (1) kinetic studies of the rates of incorporation of radioactive carbon dioxide into various metabolites of importance in photosynthesizing algae; (2) chemical degradation studies carried out in order to determine the rates of appearance of radioactivity in various positions of the molecules of metabolic importance; (3) determination of the effects of various antibiotics on the path of carbon in photosynthesis; (4) determination of the relative amounts of carbon-14 in the labeled purine and pyrimidine bases obtained from the nucleic acids of photosynthesizing algae; and (5) fundamental studies designed to improve the usefulness of paper chromatography as an aid to investigations in the field of photosynthesis.

In the field of animal biochemistry, this group is continuing with work on the following studies: (1) rates of metabolism of carbon-14 labeled fatty

acids in normal and hypophysectomized rats; and (2) work in collaboration with the Division of Medical Physics on the role of Δ^7 -cholestenol in the pathogenesis of atherosclerosis.

Work in organic chemistry during the past month has included (1) a study of the isotope effect involved in the pinacol rearrangement; (2) synthesis of sodium acetate-2- C^{14} , aspartic acid-4- C^{14} , leucine-3- C^{14} , glycine-2- C^{14} ; and (3) studies leading toward the synthesis of heptanoic acid-7- C^{14} .

10. MEDICAL PHYSICS

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Part A

(A.E.C. Program No. 6400)

Tracer Studies

Further studies on the use of the complexing agent, Versene, in altering the metabolic pattern of plutonium in the rat have been initiated. Studies of the possible toxic effects of a large number of roentgen-equivalent-physical on rat plasma, using I^{131} -tagged thyro-globulin as a tool, have continued.

Further work has been done on the study of the comparative effects of alpha and beta emitters, with Na^{24} and At^{211} . Experiments during the past month on this problem have been concerned mainly with Na^{24} .

Radioautography

I^{131} autographs from the astatine monkey thyroid are in progress. Work was also started on the problem of iodine in the pituitary gland.

Radiation Chemistry

Studies have continued on the quantitative determination of products formed in the bombardment of aqueous acetic acid solutions by heavy particle irradiation. Work has started on the separation and identification of the volatile and non-acidic fraction. Methods are being developed for the purification of oxalic acid to be used in radiation chemistry studies.

MEDICAL PHYSICS

UNCLASSIFIED

Part B

(A.E.C. Program No. 6400)

Nucleic Acid Studies

The increased post-irradiation survival of mice given multiple injections of cell-free embryo extract has been confirmed in a second strain of mice. Experiments are now in progress on the post-irradiation protection capacity of other cell-free tissue extracts. Daily injections of 1 milligram of Terramycin or Diphyrostreptomycin into normal adult mice have shown no effect on the liver desoxyribose nucleic acid (DNA) turnover. The study of the correlation of DNA turnover as measured by P^{32} with mitotic indices in the same tissue is being continued.

Studies with C¹⁴ Labelled Stilbamidine

Some A-strain (♂) mice, transplanted with S-1 sarcoma, were injected with 2 mg. choline for 5 days and then with .45 mg. C¹⁴-stilbamidine to see if an increased concentration of choline in the liver would affect stilbamidine concentration in the liver as compared to previous results with tumorous mice (not injected with choline).

Similarly, some A-strain mice with S-1 sarcoma were injected daily for 5 days with 2 mg. ascorbic acid and then .45 mg. C¹⁴-stilbamidine to see if the effect on stilbamidine concentration in the liver. The reason for using ascorbic acid is hinged upon the theory that perhaps ascorbic acid plays some role in the metabolism of tyrosine to melanin in the liver. Since we have previously found that melanoma mice are the only tumor mice that do not concentrate stilbamidine as heavily in the liver as do other tumorous mice, the question arose as to whether there could be any connection between stilbamidine concentration and tyrosine metabolism in the liver that might be influenced by saturating with ascorbic acid.

The results were negative in that liver concentration of stilbamidine in both instances of choline and ascorbic acid mice compared exactly with controls and were still at ordinary tumor level -- between 19 percent and 30 percent of total injected activity as compared to 4 percent for normal mice.

Iron Turnover Studies

A patient with chronic lymphocytic leukemia, prior to splenectomy, had an iron turnover in plasma of 136 mgm/day and an estimated iron turnover in cells of 45 mgm/day. The in vivo studies disclosed the bone marrow to be the only site of erythropoiesis. The serial counting rates at a site over the enlarged spleen exhibited a marked secondary rise. The Fe⁵⁹ in red cells failed to rise above 33 percent in ten days.

Two months after splenectomy the iron turnover in plasma was 40 mgm/day. The hematocrit had risen from the 17 percent - 20 percent range to 39 percent - 40 percent. The red cell volume increased from 1.4 liters to 2.12 liters. The plasma volume decreased from 5.3 liters to 3.15 liters. The difference in the in vivo studies supported the pre-operative diagnosis that the spleen had been destroying red cells.

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

UNCLASSIFIED

The Equipment Development group continues work on the following major projects for the chemistry department, plus numerous smaller items:

1. A highly active Canadian pile-bombarded sample, the equipment for which was partially described in the monthly progress report for the period ending January 15, 1952, was successfully processed in the 6-inch straight-type lead cave. The ball-socket manipulators, fabricated from uranium, in the wall of

the cave and extending to a box within the cave in which chemistry was performed on the sample, proved to be very satisfactory with which to work. Their presence eliminated former overhead manipulations. Likewise, the lead glass window in the wall of the cave directly above the ball-socket manipulators improved the setup greatly. A similar slug belonging to the Argonne National Laboratories that had undergone identical bombardment in the Chalk River pile was processed here at Berkeley simultaneously with UCRL's, and the Argonne portion shipped to Chicago.

2. Modifications in the pistol-grip target holders for use in the Crocker cyclotron have been made. Improvements in the cooling system for use in the same cyclotron have also been provided.
3. A new cooling system for use in the processing of plutonium "cows" has been made.
4. Target holders, or slugs, for use in the Arco pile have been designed.
5. Work is continuing on research on solidification of active liquid wastes.
6. Radioactive sources made by Health Chemistry personnel: 20 Pu²³⁹ sources for Health Chemistry monitors; one Am²⁴¹ source for Medical Physics; two Pu²³⁸ sources for the Cloud Chamber Group.
7. Eight Berkeley Boxes were assembled, fitted and delivered during this period.

12. PLANT AND EQUIPMENT

~~RESTRICTED~~

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

The final drawings of the preliminary plans are expected to be completed around the middle of November.

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

A contract for the Synchrotron Research Building has been awarded to Hugo Muller and work is planned to start the first of September.

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

Work is being continued on checking the Ion Gun and also pulsing the Magnet for checking the generators.

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

A contract has been awarded to Western Asbestos for installation of acoustical treatment of the accelerator room and work is expected to start immediately.

MAN-MONTHS EFFORT REPORT
Scientific Personnel

PROGRAM NO.	SUBDIVISION	MAN-MONTHS EFFORTS	COMMENTS
5311 Basic Chemistry Research, Part B	Metals and High Temperature Thermodynamics) Basic Chemistry, including Metal Chelates) General)	16.00	
5361 Applied Chemistry Research	Process Chemistry	7.67	
<u>Reactor and Accelerator Operation</u>			
5731 Electron Synchrotron	Operation	10.66	
5741 184-inch Cyclotron	Operation	9.86	
5751 Linear Accelerator	Operation	9.30	
<u>Biological Research</u>			
6300 Biology and Medicine	Internal Irradiation and Hematological Response	5.20	
	Health Medicine	8.20	1.22 Consul- - tant Man- Months
6400 Biological Research Part B	Instrumentation for Quantitative Measurements of Radiation	2.78	.40
	¹⁴ C Metabolism	3.30	.32
	Use of Radioactive Materials in Human Physiology and Experimental Medicine	13.88	4.99
	Trace Elements and Irradiation Studies	4.68	.48
	Radiation and Mutation Rate	2.61	.33
	Physical Biochemistry	15.35	4.38
	Biochemical Response to Irradiation	4.08	.50
	Miscellaneous	4.65	4.45
	Metabolism of Lipo Protein and Lipids	4.56	12.46
	Iron Metabolism Hematopoiesis	3.35	1.00
	Synthetic and Experimental Organic Chemistry	25.23	-
	Metabolism of Fission Products	18.96	-

MAN-MONTHS EFFORT REPORT
Scientific Personnel

PROGRAM NO.	SUBDIVISION	MAN-MONTHS EFFORTS	COMMENTS
6500 Biophysics Research	Biological Effects of Cosmic Radiation	2.18	.22
	Health Physics	1.54	-

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