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UNIVERSITY OF CALIFORNIA

Radiation Laboratory

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MONTHLY PROGRESS REPORT
No. 110

May 15, 1952 to June 15, 1952

July 8, 1952

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UNIVERSITY OF CALIFORNIA, RADIATION LABORATORY

May 15, 1952 to June 15, 1952

MONTHLY PROGRESS REPORT No. 110*

July 8, 1952

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

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Coil Winding

Eighty-one percent (143 turns) of the fourth quadrant is now wound, and the winding is expected to be completed by June 25.

Magnet

Preparations are being made for the magnet test without pole pieces to start on July 15. Because of delays in the model tests for determining the final pole tip shape, the fabricator was told to go ahead with the existing shape. However, the steel strike postponed fabrication, and advantage is being taken of this delay to complete the model tests. It now appears that a shaped pole profile rather than the previously planned straight edged pole will be required to obtain maximum useful width of field. The first samples of the pole tip stanchions (nickel cast-iron) received from Mare Island Shipyard were found to be magnetic, but it appears that improved foundry practice may correct this trouble.

Vacuum System

Mare Island has started fabrication of the straight tanks, and the first tank will probably be completed by September 1. Hycar samples of the curved tank gaskets received approximately two years ago are deteriorating due to oxidation. Several alternatives being considered for reducing this oxidation are a shorter cure period for the hycar or the application of "Blackout" plastic coating or of a lubricant to the hycar surfaces. The filler frame (for supporting the vacuum tank in the area left unsupported by the smaller pole tips) will be redesigned from the present aluminum casting to reduce eddy current heating.

Injector

A mercury diffusion pump will be used for the ion gun. The suitability of oil diffusion pumps for the linac will be determined during the initial operational tests. The ion gun enclosure is now being built.

* Previous report UCRL-1844 (No. 109)

~~SECRET~~

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

The cyclotron was used for research experiments approximately 94 percent of the 515 hours that the crew was on duty. The time distribution was as follows:

Operation for customers	485.5 hours	94.2 percent
Electrical troubles	8.5	1.6
Mechanical troubles	10.5	2.0
Power shutdown	6.0	1.3
Other	5.0	0.9
Total	515.5 hours	100.0 percent

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

In general the operation of the 60-inch cyclotron during this month was good. The schedule has been cut back from 32 to 28 month days per week because of the impending decrease in bombardment requests due to vacation inactivity.

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

During this month the synchrotron was brought back to operating condition. The main process which accomplished this was the replating of all the quartz sections. Each of the seven (the rf section was not changed) was sandblasted and sprayed with a single coat of silver paint. As soon as the machine was put together again, a beam was found, and it was rapidly worked up to a good operating condition. Consequently, as the month ended, experiments were beginning again.

Previous to the above-mentioned operation, it was impossible to get a satisfactory beam at full magnet voltage (full electron energy). Whereas there was no such indication of the trouble, it seems now that the coating was mainly responsible.

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

The second electron magnet of the linear accelerator has been constructed and is ready for installation. The power supply for the unit is being constructed. When installed, just behind the present electron magnet, it will allow less exit electron error in the current coil beam monitor.

A microvolt sensitive amplifier is now ready for test, in place of the previous millivolt sensitive unit. This will permit beam current resolution to the microvolt noise level within the shield of the current coil.

A simple error signal amplifier is in the test stage for the rf monitor system. This two tube amplifier allows accuracies comparable to the slide back volt meter in this application.

Statistics

Running time	87 percent
Maintenance	5.5 percent
Repair	7.5 percent

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

UNCLASSIFIED

Film Program

Spall Analysis. Using the occurrence of a "hammer" at the end of tracks to identify the spall as Li^8 or B^8 , a range-radius of curvature analysis has revealed that many of the spalls are bent in the magnetic field with less than their maximum charge. Five loci are identifiable as Li_3 , Li_2 , B_5 , B_4 , and B_3 . In addition, many short range hammer tracks are found which doubtless are tracks of spalls carrying even smaller net charges. From the loci obtained range-energy curves can be constructed for lithium and boron isotopes.

The microscope measurements of the spallation products of Be and C under bombardment with 330 Mev protons have been completed. Many target elements have now been run in the cyclotron with proton, deuteron and alpha-particle beams. A new piece of apparatus has been built and several runs have been made on the angular distribution of the spallation products.

Other Projects. Activity is continuing on a number of other projects, which however have not yielded new data for reporting at this time. They include: negative meson production and behavior, studies of meson production, meson masses and the energy balance in meson decay, large angle meson scattering, high energy beta spectra, high energy electron processes, and diffraction and coulomb scattering of high energy protons.

Cloud Chamber

A run using the pantograph cloud chamber has been made. Neutrons from a target in the proton beam were collimated out through the meson hole and into the cloud chamber, which contained hydrogen. The purpose of this experiment was to determine the energy spectrum of the neutrons. The pictures were of satisfactory quality and are now being measured.

Drawings for a new high pressure (35 atmospheres) continuously sensitive cloud chamber are being checked and are ready to go into the shop.

Film is being read and results tabulated for the experiment concerned with 270 Mev neutron-induced stars in oxygen. Film is also being read for the small angle n-p scattering experiment.

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

One run has been made at the cyclotron using reduced energy proton beam. The proton beam energy was attenuated by being passed through lithium absorbers, as is the usual practice. The beam energy came out somewhat lower than was expected, and the reason for this is still under investigation. It is not certain that possible leaks in the cans which contain the lithium could not have caused weight changes in the absorbers.

The liquid hydrogen target behaved very satisfactorily.

Comparisons were made between the ion chambers and the Faraday cup. These were not completely satisfactory. The two ionization chambers used differ significantly from each other, and the reason for this difference is still under investigation. Aside from this difference there was too much irregular drift in the Faraday cup and its electrometer. If a vibrating reed electrometer is available, the comparison will probably be repeated in the future, with greater precision and certainty. The present results agree with results of two years ago to about three percent, however there is good reason to attempt better precision in the future.

Total Proton-Proton Scattering Cross Section (345 Mev)

The parts for the liquid hydrogen target have been completed ahead of schedule thanks to excellent cooperation from the Engineering Department and the Shops. The target is to be assembled and vacuum-tested in the near future, within the structure of Cook's original liquid hydrogen target.

Effects of Chemical Binding on the Stopping Power of Substances for High Energy Protons

This work is virtually complete. A short run to check a few doubtful substances will be made soon. A final report should be issued within the next two months.

Neutron Time of Flight

Time of flight instrumentation is completed and tested. A single pulse of neutrons can be obtained for either 180 Mev deuteron stripping or 345 Mev proton exchange. Pulse is about 2×10^{-8} sec. wide at the base.

Ratio of Charged Mesons from Carbon Bombarded by High Energy Neutrons

Experiments are being continued on the ratio of charged mesons from carbon bombarded by a 280 Mev neutron beam. The solid angle for the time of flight detectors has been increased by joining scintillation counters in parallel. Eighteen photo tubes and scintillators are being used. The parallel arrangements have not decreased the efficiency or time resolution of the individual counters. The counters are placed two meters apart and a magnetic channel is placed midway. The magnet is a physically small water-cooled system, having 8 in. pole faces, spaced by 3 inches. A maximum field of 10^4 gauss is obtained so that the mesons are deflected through 45° . With the apparatus set to observe 60 Mev mesons ± 20 Mev leaving a carbon target at 15° to the neutron beam, 6 π^- mesons per minute have been observed. Accidents and counts with zero magnetic field were about 2 percent. Reversing the field for π^+ mesons, the rate was approximately twice background, so that the π^-/π^+ ratio is uncertain but large. Earlier measurements at this Laboratory had given $\pi^-/\pi^+ \approx 3$, at this angle, but it is fairly sure this value is wrong because of uncertain background in the π^+ measurement.

Nuclear Cross Sections for Elastic and Inelastic Collisions for 280 Mev Neutrons

Further data during the last month have given an improving picture of the angular distributions of neutrons scattered from carbon, aluminum, copper and lead. Total elastic scattering cross sections appear to be complementary to the measurements of attenuation cross sections using poor geometry. The inelastic cross sections (poor geometry) are larger than the elastic cross sections and comprise about $2/3$ of the total cross section for neutrons of this energy.

Attempts to measure p-n scattering for very small neutron angles utilizing this same apparatus are being made. The results at present are not reliable enough to warrant quoting.

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

Better data obtained in this month's run enable a fairly certain identification of the triton process. After a CD_2-C difference was obtained at a pair of correlated angles predicted by conservation of energy and momentum, the following tests were made and the difference observed to disappear: (1) Co-planarity. One telescope was lowered below the plane formed by the beam axis and the line from the target to the other telescope. (2) Angular Correlation. While one telescope remained fixed, the other telescope was moved away from the correlated angle. (3) Energy Correlation. Enough absorber to stop a particle of the expected energy was added to either telescope. (4) Velocity Correlation. Because the triton telescope is much farther from the target than the pion telescope (by a factor of ten), the triton time of flight can be

measured. When delay lines to compensate for this time of flight (thus synchronizing the telescope pulses at the coincidence circuit) are added, the maximum CD₂-C difference is obtained. When an additional section of delay line which is larger than the resolving time of the coincidence circuit is added or subtracted, the CD₂-C difference disappears. This test not only checks the velocity of the particles in the triton telescope, but also shows the process being observed is correlated in time.

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

UNCLASSIFIED

Higher order corrections to the nuclear force have been calculated for the pseudoscalar meson theory with pseudoscalar coupling. These corrections are large enough to invalidate perturbation procedures.

A classical model for the motion of the nucleon spin in a meson field is being studied in detail.

Work continues on bevatron pole tip design.

The study of exchange current effects in photo-deuteron processes is continuing.

The high energy scattering properties of meson theoretic potentials are under investigation. Saturation properties are also being considered.

Work on polarization effects in high energy p-p scattering is being concluded.

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

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Mark I Operation

On May 19 a 1 milliamper proton beam at A-12 gradient was obtained from the Mark I accelerator. The measured beam current was lower than the actual beam current since the four inch Faraday cup used for current measurements collects ions from only a small portion of the beam area. Also, the focusing magnets in the last few drift tubes were not operating at the designed flux, which allowed the beam to diverge. Beam energy is being determined by measurements of range of the accelerated particles in various materials.

During the previous week the tank voltage rose steadily to 20.5 million volts with all drift tube magnets functioning. At this point serious sparking developed between the Number 0 and the Number 1 drift tubes. After

the first spark it was impossible to re-excite the tank to the 20.5 million volts. It was thought that a crack or some other local source of ions had developed in the surface of either the drift tube Number 1 or 0. In an attempt to remedy the sparking conditions all drift tube magnets were de-energized and several gases, including air, helium and hydrogen, were added to the vessel. It was found that the addition of hydrogen decreased and sparking frequency sufficiently to allow the rf voltage on the tank to reach 19.5 million volts. At this point the magnets were again excited whereupon the tank voltage rose to 20 million volts when sparking again occurred. After several such cycles it was decided to hold the voltage at 19 million volts and attempt to get a beam.

The addition of hydrogen to the vessel caused numerous fine cracks to appear on the vacuum surface of the viewing ports. To prevent the weakened glass ports from collapsing, vacuum tight lucite windows were installed on the air side with provision made to evacuate the space between the lucite and the glass.

Mark I Repairs and Modifications

The accelerator was operated until June 9 when it was shut down for repairs, and for certain modifications and changes to achieve steadier operation and to reduce sparking. The major repair jobs include elimination of the remaining vacuum leaks in the vessel, installation of larger beam measuring devices, improvement in the operating efficiency of the entire pumping system and the thorough cleaning of all drift tubes. Other changes planned while the vessel is inoperative include additional diffusion pumps, installation of internal cooling coils in diffusion pumps, to the extent that time permits, and improvements in the liquid nitrogen control system. Drift tubes Numbers 0, 1 and 2 will be repaired, including a complete surface re-cleaning. New bore tubes for Number 0 and Number 1 tubes for later installation will be prepared and the designs will proceed on a revised shape for new drift tubes Numbers 0 and 1 to be faced with molybdenum or other new surface material. The final design and surfacing will depend on further tests on the XC cavity and Mark I operation. Since past operation indicates that the beam characteristics can be studied at proton gradient without rapid spark damage to drift tube surfaces, it is not planned to withhold vessel operation until the molybdenum face drift tube shells are fabricated.

A new vacuum lock will be installed at the beam exit to permit an 18 inch by 18 inch target with graphite button facing to be used in studying the beam profile. The beam current pick-up produced in the graphite buttons will roughly indicate the beam area intensity distribution and beam current. A more accurate target and beam monitoring device is also being developed. The spark damage between drift tubes Numbers 0 and 1 is thought to be the result of the time delay in dumping the stored energy in the vessel with the

present crowbar. The addition of a second spark gap at the front end may eliminate or reduce this problem. The governing item in the determination of the total shutdown time is the installation of a large test target and precessor.

Vacuum Studies with B-1 Cavity

The B-1 cavity has been operated successfully with the mercury diffusion pump baffles cooled to -60°C instead of the usual liquid nitrogen temperature of -196°C . The quantity of mercury that back streams past the baffle is not known but this quantity has not been found to increase the sparking problem. If it is possible to cool the mercury diffusion pump baffles at temperatures higher than liquid nitrogen the quantity of liquid nitrogen needed for cooling on Mark I and A-12 can be substantially reduced with a considerable financial savings.

Heat Loads on Targets

A new series of calculations of the heat loads on the primary and secondary targets have been made. The earlier calculations were made by following a path of an isolated deuteron, with 170 Mev added for each fission, and if a proton was formed, by following it until it suffered ionization. This procedure, however, neglects secondary reactions. The new calculations have been approached from the standpoint of a heat and mass balance around the primary and secondary targets. The new calculation of the heat load for 190 Mev deuterons gives a total of 200 Mev per deuteron in the primary and 110 Mev in the secondary. The same calculation done for 350 Mev deuterons employing the best extrapolated numbers gives a heat load in Mev per deuteron of 470 for the primary target and 225 for the secondary. This primary heat load is approximately 30 percent greater than that previously calculated.

Angular Distribution of Neutrons from Moderated Targets

A series of measurements have been made of the angular distribution of neutrons from moderated primary, and moderated primary plus secondary targets. In these measurements a long boron trifluoride counter encased in paraffin was used. The primary target was composed of 3 foot by 3 foot slabs of 1/16 inch thick uranium and 3/32 inch thick polyethylene and contained 1 inch of uranium (16 uranium slabs). The secondary target consisted of 3 foot by 3 foot slabs of 1/2 inch thick uranium and 3/32 inch polyethylene with the equivalent of 4 inches of uranium (eight slabs). These targets were placed in the cave of the cyclotron and bombarded with deuterons. A radium-beryllium source was used to calibrate the counter. The angular distribution of neutrons detected from the primary target alone was almost symmetrical and gave an average yield of 1.7 neutrons per deuteron. The yield for the primary plus secondary gave 1.8 neutrons per deuteron. In both cases the results are lower than expected but can be explained on the bases that neutrons of energy over 20 Mev are not detected, and furthermore there is a considerable number of stripped neutrons from the target.

Measurements were also made on a thin target 1/8 inch thick and 5 inches square. This measurement was made to determine the differential cross section for producing 1 neutron. The cross section was found to be 38 barns.

Absorption of Lattice Neutrons by the A-12 Primary Target

The problem of estimating the production and heating in the A-12 primary target due to the capture of neutrons from the lattice is being studied. Because of the complexity of the geometry, the calculations must be approached by methods of approximation. Involved in the calculations is the solution of the three group diffusion equations for a multiplying lattice. Thus far the calculation is quite tentative and it is hoped that it may be refined somewhat without making the work prohibitive. The loss coefficients obtained from this calculation are similar to those used until now. However, closer estimates of the production, heating and losses due to the target will be possible.

Water Blanket Measurements

Measurements reported earlier on the effect of a water blanket between the lattice and the vacuum vessel on production has been extended. In these measurements metal foils are placed within the uranium rods exposed to the neutron flux and counted to measure the plutonium production. When sufficient foils are counted a measure of the production may be obtained by integrating over the assembly. In this manner the production as a function of water blanket thickness is determined.

Other Target Studies

The following studies are also being made. The large MnSO_4 tank for use in determining the total yield from targets of large cross section will be available for use in about two weeks. Rather than depend on the integration of angular distribution obtained with the boron-trifluoride counter, the tank method will be used for determining the total yield. The spectrum of neutrons from thin uranium targets bombarded in the energy range from 1/2 to 2 Mev is being investigated in collaboration with the Cloud Chamber Group. Work on the energy and angular distribution of high energy protons from deuteron bombardment, particularly of beryllium and uranium using the proportional telescope, is continuing. Some difficulty with the gating circuit has made analysis of the data somewhat more difficult than it should be. These results will be reported later.

9. CHEMISTRY

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Part A

(A.E.C. Program No. 5311)

Spallation and Fission Yields

Work is in progress on the measurement of yield distributions of

tantalum and of silver bombarded with 340 Mev protons. Values have been obtained for ten nuclides from tantalum fission. Hafnium has been separated by ion exchange, but the decay curve has not been resolved. Seven elements have been separated from the silver targets, but the data have not yet been evaluated.

Electromagnetic Radiations of Np²³⁹

The bent crystal spectrometer has been used to examine the electromagnetic radiations of Np²³⁹. Thirteen plutonium L x-rays and plutonium K₁ and K₂ were observed, as well as gamma rays of 61.8 and 57.6 kev. Two other weak lines may be gamma rays or second order reflections of the K x-rays.

Decay of Bi²¹⁰

A sample of the long-lived isomeric state of Bi²¹⁰ was purified of Po²¹⁰ and then allowed to stand. A subsequent milking of Po²¹⁰ showed that one nucleus decays to Po²¹⁰ for approximately 350 that decay by alpha emission. Thus the rate of decay to Po²¹⁰ corresponds to a half-life of $\sim 3 \times 10^8$ years.

If this decay is by direct beta decay, the spin change is probably 4, and the long-lived state is the ground state with spin 4. If the long-lived state is the excited state, it must have a spin much greater than 4 and the decay is primarily isomeric transition to RaE, followed by beta decay.

Absorption Spectrum of NdF₃

Fourteen lines have been observed in the absorption spectrum of NdF₃ at room temperature. The powdered NdF₃ was mounted in a cell of 0.005 inch thickness mixed with CS₂.

Radiation Chemistry of Organic Materials

More complete data have been obtained for the yields of gas fractions from n-octyl and n-decyl alcohols irradiated in the cyclotron. Ethylene is formed in higher yield than ethane, while the higher saturated hydrocarbons are formed in yields two to three times the corresponding unsaturated ones.

Preliminary values have been obtained for the yields from radiolysis of di-isopropyl ether, and they agree in order of magnitude with those predicted from the mass spectrometer pattern of this substance.

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. A summary of gaseous hydroxides has been written and issued as report UCRL-1831.
3. Thermal conductivity of gases. Report UCRL-1852 has been issued.
4. Gaseous molecules.
5. Gaseous oxides.
6. 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)

UNCLASSIFIED

Organic biochemistry, animal biochemistry, and plant biochemistry research problems have been investigated in the past month. In the animal biochemistry studies an apparatus for the determination of breath carbon-14 dioxide eliminated by rats injected with labeled compounds has been developed and used in a number of experiments on the effects of drugs on metabolism processes. This apparatus permits the continuous measuring of activity in the breath and the data is plotted directly on a recorder chart. The results may be easily integrated with a polar planimeter to give total carbon-14 exhaled for any time interval.

The work on the Δ^7 -cholesterol (lithosterol) content of samples of normals and atherosclerotic patients' serum has continued with both synthesis of the compounds and plans for feeding of the material to animals.

The synthesis of high specific activity leucine-3-C¹⁴ has been re-approached. The present preparation has now been thoroughly checked and yields as high as 40 percent are expected in the current work. Other carbon-14 labeled compounds prepared in the last month include choline, acetyl choline, sodium isobutyrate, sodium acetate, sodium formate, and methyl iodide. Several isotope effect experiments are being done in an active program of improvement of assay techniques for carbon-14 is underway.

The search for photosynthesis intermediates, especially for four carbon carboxylation products other than malic acid, has continued in plant biochemistry. A previously unidentified glucose phosphate spot on paper chromatograms of algae has been identified as uridine, and it is almost certain that some inosine is present. These nucleotides are apparently fairly important in photosynthesis, but their exact function is not yet known. The influence of chemicals on carbon dioxide fixation has been investigated with aminopterin and aureomycin. The first of these two materials does not effect carbon dioxide fixation rates materially, but the latter apparently accelerates fixation in the light.

10. MEDICAL PHYSICS

UNCLASSIFIED

Part A

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

Tracer Studies

Studies upon the effect of calcium EDTA upon plutonium metabolism in rats have been completed and are being prepared for publication. Studies upon the effects of fission products in monkeys are being continued.

An investigation of the effect of high energy alpha-particles upon normal rat plasma has been initiated.

Radioautography

Work is in progress on the autopsy material from the fission product animals, rats and monkeys. Thyroid autographs with I¹³¹ from the control monkey are being completed.

Radiation Chemistry

Methods have been developed for the determination of hydrogen peroxide and organic peroxides in bombarded acetic acid solutions. The data show a linear relationship between hydrogen peroxide and the total energy absorbed. No organic peroxides could be detected. Several additional non-volatile acid products have been identified by co-chromatograph techniques and by melting point determinations. Gas analyses have been obtained for certain bombardment conditions.

MEDICAL PHYSICS

UNCLASSIFIED

Part B

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

Biological Work with the 184-inch Cyclotron

Experiments were conducted on the effects of high energy deuterons on the pituitary and hypothalamic regions of rats. It was shown that rats receiving 20,000 rep to the pituitary developed an anemia several months after irradiation which was reflected in partially decreased blood volume. This observation adds to the data on hand concerning the role of the pituitary on hemopoiesis.

The body water of a few obese rats which received 5,000 rep of deuterons in the hypothalamic region was tested six months after exposure to radiation. The tritium dilution technique was employed. The body water was found to be normal. Most of the weight gain of the radiated animals can be thus attributed to increase in body fat.

Biological Effects of Radiation on Micro-organisms

New soft x-ray equipment was installed and is now operating. This will enable us to test the behavior of yeast and bacterial survival curves at very high doses and at high dose rate. New data were obtained on the haploid yeast survival curve at high doses.

Instrumentation

The multiple scintillation counter apparatus is being used routinely now to obtain distribution of gamma emitters in the human body. Two patients were used as subjects in an experiment to determine the size and location of their spleens. They were given a small dose of radioactive colloidal gold. A few minutes after the i.v. injection a definite image of the spleen was obtained; the liver image proved to be brighter than that of the spleen, probably due to the greater mass of the liver.

Effects of Altitude on the Life Span of the Red Blood Cell

A study of the life span of red blood cells in rats subjected to high altitude stress has been carried out. The life span of the red cells was measured using the technique of labelling the hemoglobin with radioactive carbon (C^{14}) in the form of glycine.

The observations showed that the red cells formed during the first few days of exposure to high altitude appear to be of two types: some normal and others probably imperfect with a considerably shortened life span. When an animal has become acclimatized to high altitudes, the red cells present have a normal life span.

Nucleic Acid Studies

In a previous report it was noted that the repeated injection of various homologous tissue fractions increased the desoxyribonucleic acid (DNA) turnover in the livers and spleens of A strain mice. Embryo mash given repeatedly to irradiated mice relieved the severe depression of DNA turnover caused by irradiation. It was suggested that these preparations administered after irradiation might improve the survival of mice, presumably by stimulating mitosis.

Two preliminary post irradiation survival experiments have been made and show a significant differential of protection between mice receiving saline and those receiving embryo extract.

Male A strain mice were irradiated with 840 r x-rays and divided into two groups. The control group received saline while the other group received the extract from approximately 0.7 gm embryonic tissue divided in 10 doses.

An experiment was performed to test the effect of heterologous serum (human) on the DNA turnover and post irradiation survival of mice. Stroud and Brues found that dog plasma injection prior to irradiation partially protects mice while it is not effective if given after irradiation. (Reported, Stroud, A.N., and Brues, A.M.: Federation Proceedings 11, 155, 1952).

Human serum (0.15 cc daily for 7 days intraperitoneally) was found to markedly increase the DNA specific activity in the livers of 20 mice as compared to 20 controls. However, when the serum was given to a group of 24 irradiated mice (840 r) they showed no increased survival compared to the saline control group.

It would thus appear from these preliminary experiments that the mechanism of mitotic stimulation (increased DNA turnover) is different in the case of homologous tissue extract and heterologous serum injections. The former is effective after irradiation while the latter is not.

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

UNCLASSIFIED

Equipment Development Group

1. Work continues on preparation for processing a highly active Canadian pile-bombarded sample at the end of July. A partial description of the equipment was given in the progress report for December 15, 1951, to January 15, 1952. Another Canadian pile-bombarded sample was received during the present period and processed in the equipment set up in the 2 inch lead cave and auxiliary pieces.

2. Equipment has been prepared for the second phase of processing the americium milked from plutonium slug-type cows received from Los Alamos.
3. Work has been done on equipment for recovering americium from barrels of solution from Hanford.
4. Equipment is being readied for recovering neptunium from materials received from Hanford.
5. Ten gloved boxes have been provided by the Berkeley Box group.

During this period the following two incidents occurred, resolution of which was effected by members of Health Chemistry and other interested parties:

Decontamination

An area became contaminated subsequent to high-pressure spraying of plutonium in a solution being heated within a gloved box. This material forced its way through seams of the box. The room has been decontaminated and is awaiting completion of necessary work to be done by the craftsmen. The plutonium has been recovered from the box in which it occurred. No jeopardization of health of personnel occurred because of this incident.

Curium contamination was detected around the 60-inch cyclotron area. It was thought to be due to contamination of the vacuum line system. The areas were decontaminated and modifications in the equipment used in the bombardment of sizeable quantities of highly active alpha emitters are being made to insure prevention of reoccurrence.

12. PLANT AND EQUIPMENT

RESTRICTED

Chemistry Laboratory Building. (Program No. 9500. 5-424-1002) There has been no further progress on the Chemistry Laboratory Building, as no approval has yet been made on the preliminary plans.

Bevatron Instrument. (Program No. 9500. 5-424-9001) Winding is approximately 90 percent complete. The Injector System, including the Linear Accelerator and Ion Gun, is approximately 10 percent complete. In the Control Room racks for instruments and control circuits have been installed.

Animal House. (Program No. 9600. 6-424-9007) Paving and landscaping around the Animal House has been completed.

Radiological Laboratory at the U.C. Medical Center. (Program No. 9600. 6-424-9008) Plans for the acoustical treatment of the accelerator room have been completed and an order will be placed within the next ten days.

MAN-MONTHS EFFORT REPORT
Scientific Personnel

PROGRAM NO.	SUBDIVISION	MAN-MONTHS EFFORTS	COMMENTS
9500	Bevatron		
	Miscellaneous	5.59	
<u>Operations</u>			
2000	M.T.A.		
	Design and Development	68.20	
3000	Weapons Research		
	General	18.82	
5211	Physics Research		
	Experimental Physics		
	Cloud Chamber	12.81	
	General Physics Research	41.99	
	Instrument for General Use	2.84	
	Magnetic Measuring	1.78	
	Theoretical Physics		
	General	11.43	
	Photographic Film Detectors		
	General	15.89	
5261	Applied Physics Research		
	Mark III Cyclotron		
	Electron and X-C Models	15.24	
<u>Chemistry Research</u>			
5311	Basic Chemistry Research, Part A		
	Chemistry of Heavy Elements	3.67	
	Nuclear Properties of Heavy Element Isotopes	8.04	
	Transmutations with 184-in. and 60-in. Cyclotrons	7.45	
	Analytical and Services	18.99	
	Special Chemistry Development	1.00	
	Mass Spectroscopy, Beta Ray Spectroscopy	1.00	
	Instrument Development and Services	3.05	
	X-Ray Crystallographic Measurements	2.83	
	Health Chemistry Research	10.83	

MAN-MONTHS EFFORT REPORT
Scientific Personnel

PROGRAM NO.	SUBDIVISION	MAN-MONTHS EFFORTS	COMMENTS
<u>Chemistry Research (cont.)</u>			
5311 Basic Chemistry Research, Part B	Metals and High Temperature Thermodynamics	6.50	
	Basic Chemistry, including Metal Chelates	4.50	
5361 Applied Chemistry Research	Process Chemistry	4.14	
<u>Reactor and Accelerator Operation</u>			
5731 Electron Synchrotron	Operation	4.98	
5741 184-inch Cyclotron	Operation	15.33	
5751 Linear Accelerator	Operation	9.35	
6300 Biology and Medicine	Internal Irradiation and Hematological Response	5.50	1.24 Consultant - Man-Months
	Health Medicine	7.61	
6400 Biological Research Part A	Metabolic Properties of Various Materials	10.0	
	Radio Chemistry and Radiation Chemistry	6.0	
	Radioautography	2.0	
6400 Biological Research Part B	Instrumentation for Quantitative Measurements of Radiation	3.12	0.40
	¹⁴ C Metabolism	2.07	0.85
	Use of Radioactive Materials in Human Physiology and Experimental Medicine	12.25	6.78
	Trace Elements and Irradiation Studies	7.44	1.84
	Radiation and Mutation Rate	2.36	0.35
	Physical Biochemistry	12.72	4.32

MAN-MONTHS EFFORT REPORT
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PROGRAM No.	SUBDIVISION	MAN-MONTHS EFFORTS	COMMENTS	
6400 Biological Research Part B (Cont.)	Biochemical Response to Irradiation	4.68	0.25	
	Miscellaneous	4.90	3.85	
	Metabolism of Lipo Protein and Lipids	4.60	12.66	
	Iron Metabolism Hematopoiesis	1.99	1.00	
	Metabolism of Fission Products	17.80	-	
	Synthetic and Experimental Chemistry	5.62		
	Biological Chemistry	5.72		
	Photosynthesis Chemistry	6.25		
	6500 Biophysics Research	Biological Effects of Cosmic Radiation	2.04	0.25
		Health Physics	1.742	-

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