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**RADIATION LABORATORY**

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UNIVERSITY OF CALIFORNIA

Radiation Laboratory

Contract No. W-7405-eng-48

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MONTHLY PROGRESS REPORT NO. 117

December 15, 1952 to January 15, 1953

February 4, 1953

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Berkeley, California

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BY B. J. Fink 3-22-57  
SIGNATURE OF THE PERSON MAKING THE CHANGE DATE

UNIVERSITY OF CALIFORNIA, RADIATION LABORATORY

December 15, 1952 to January 15, 1953

MONTHLY PROGRESS REPORT NO. 117\*

February 4, 1953

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

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Photoproduction of Negative Pions from Deuterium

The coincidence detection of negative pions and protons is proceeding as reported previously. The high energy end of the meson spectrum was examined for the nucleon spin-flip probability. The data are being analyzed to draw some conclusions.

Internal Momentum Distributions

The 35 geiger tubes previously used with the magnetic particle spectrometer to determine the particle energies have now been replaced by 35 anthracene scintillation counters using 931A photomultiplier tubes. This step was taken to avoid the high background counting rate and long dead time encountered with geiger tubes. The amplifiers used with the geiger tubes are still being used after only slight modification.

A run was made using the scattered deflected proton beam from the 184-inch cyclotron and employing a geometry already discussed in previous monthly reports. This run showed that the 35 scintillators were counting protons from the target with good efficiencies, and further, that the accidental counting rates of the scintillators were a small fraction of the real counting rates. Proof that the equipment was working was evidenced by the fact that a fairly sharp peak in the energy spectrum from a  $\text{CH}_2$  target was observed. This peak was formed by protons resulting from collisions of beam protons with H atoms in the target. The energy of the scattered protons at a given angle to the beam is in this case uniquely determined. When a carbon target was used the peak was not observed. With the carbon target it was found that the coincidence counts formed by the signals from the scintillator telescope (used to detect one of the scattered protons) and the signals from the three proportional counters in the magnetic spectrometer (which detects the other scattered particles) were almost completely accidentals. These coincidence counts were the signals used to allow signals from the 35 scintillators to be recorded. Using a  $\text{CH}_2$  target the majority of coincidence counts were real and corresponded to collisions with the H atoms in the target.

Because of this situation we are at present replacing the proportional counters used in the magnetic spectrometer by thin scintillators which will not cause too much small angle scattering and will allow the resolving

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\* Previous report UCRL-2072 (No. 116).

time of the coincidence circuit to be changed from about  $10^{-6}$  seconds to  $10^{-8}$  seconds. This change should decrease the accidental coincidences a great deal without resulting in a loss of real coincidences.

### The Spectrum Studies of Proton Bremsstrahlung and $\pi^0$ Decay

The pair spectrometer, specifically designed for the region from 15 to 100 Mev, has been brought into successful operation. The revised technique of operation, in which the quadruple proportional counter coincidence is dispensed with, has been satisfactory for any direction of the proton beam at the target. At present, an extended series of numerical evaluations for pair production cross sections as a function of energy and of the division of energy between the electron and positron are being made. Also, a target beam monitor operating upon the basis of the target temperature has been prepared for runs to follow.

### Elastic Photo-Production of $\pi^0$ Mesons in Deuterium

Instrumentation for this experiment is essentially complete. Calculations of the kinematics for the reaction have been performed and the first attempt to observe this progress will be made as the schedule allows.

### Deuterium Liquefiers

The parts to the deuterium liquefier have now been delivered from the shop and the device has been assembled and partially tested. The next step is to proceed with the actual use of liquid hydrogen in performing the process which will be involved in liquefying deuterium.

### Elastic Proton-Deuteron Scattering Using 345 Mev Protons

Considerable reworking of the equipment is under way to increase the rate at which data can be taken. In the arrangement in which deuterons are separated from protons by their pulse heights in two counters, the photography of the pulses has been the slowest link and rather low counting rates have been used. The Techtronix model 517 is now available for use. This oscilloscope will enable us to photograph the scintillation counter pulses directly as they come out of the distributed amplifier. The slow circuit formerly used to allow reliable photography will be eliminated.

### Proton-Proton Scattering at Small Angles (160 to 250 Mev)

One run has been devoted to the problem of how best to collimate the reduced energy beam. In as much as there is an appreciable amount of scattering in the beryllium pieces that are used to reduce the proton energy, it is quite important to make the best available collimation, to keep background to a minimum. This run is believed to have been a considerable success, however, the real test will come during the next runs when it should be possible to make quite quantitative estimates of the background in the new arrangement as compared with the old.

### Neutron-Proton Scattering at Small Angles (90 and 270 Mev)

A thin counter is under construction which is to be used next to the CH<sub>2</sub> neutron converter in the neutron counting telescope. It is essential that it be quite thin in order to emphasize the effect of the converter over the conversion power of the counter itself.

Some further shielding of the neutron beam is being arranged. In conjunction with this shielding we will try what is hoped will be a simple system for reducing the background due to air in the beam path. A thin aluminum box is being constructed which is quite long in the direction of the beam. The beam passes through this box, entering and leaving through thin aluminum windows. The box is to be filled with helium. It is hoped that by displacing air with the less dense helium a background comparable to that obtainable with a vacuum box may be attained.

### Scintillation of Argon Gas Caused by Alpha-Particles

Argon gas is found to give out light under alpha-bombardment providing the argon is quite pure and providing it is in an electric field. Alpha-particles have been counted quite nicely with this light and it has been shown that small concentrations of carbon dioxide quench the light, although they do not affect the current collected in the ionization chamber. Electric fields of 500 volts per centimeter are advantageous. The light output is still increasing with increasing electric field as this field is reached, whereas ionization is saturated.

Thus far there is good proof that the scintillation is due to the alpha-particles, but the details of the mechanism are quite uncertain.

Very shortly after this work was started it was learned that very similar studies are in progress at Brookhaven National Laboratory.

### Search for Stable Tc

A first run with Kennecott residues has failed to reveal any technetium.

### Time-of-Flight Neutron Spectroscopy

A run was made on December 20, 21, 1952, at a distance of 68 meters, using only lead as the scatterer. The intention was to obtain sufficient data so as to resolve any small variations in total cross section with energy. Forty 100-foot reels of film were taken, which are currently being analyzed.

### $p + p \rightarrow d + \pi^+$ Differential Cross Section

The above reaction is being investigated with proton energies of 340 Mev, 335 Mev, and 327 Mev. The cross section is measured by detecting

the meson and deuteron in coincidence. The angular distribution in the center of mass system at 335 Mev is

$$\frac{d\sigma}{d\Omega}(\theta) = 33 \left[ 0.32 (1 \pm 0.12) + \cos^2 \theta \right] \times 10^{-30} \text{ cm}^2 \text{ ster}^{-1}.$$

The total cross section is

$$\sigma_T = 2.7 (1 \pm 0.1) \times 10^{-28} \text{ cm}^2.$$

These above data have not as yet been corrected for  $\pi$ - $\mu$  decay in flight and other small systematic errors.

Data are now being analyzed at 340 Mev and 327 Mev and cross sections for  $30^\circ$  and  $90^\circ$  in the center of mass system are forthcoming.

### Beta Ray Spectrometer

Drawings for the linear accelerator beta ray spectrometer have been nearly completed. The gray wedge pulse height analyzer has been completed to a point where it can be used. A spectrum has been produced with it and compared to that produced electronically. The Exakta camera, loaned to us by Prof. Tobias, has been returned. With the Exakta it was possible to see single pulses, while with the camera still available to us it is possible to see only groups of ten or more pulses. A new wedge has been obtained, which appears to be of good quality.

### Film Program

The 22-inch meson spectrometer magnet was completed and a run was made with it in the cyclotron cave. All the adjustments were found to operate satisfactorily.

The analysis has been completed of the secondary particles emitted in the forward direction from Be, Al, Ni, Ag, Au, and U under bombardment by 375 Mev alpha particles. Results not dissimilar to those with proton bombardment were obtained. Study of the angular distribution of the various products and their dependence on the character of the beam and its energy are continuing. In another phase of the program, the  $\text{He}^3/\text{He}^4$  ratio produced on bombardment of Ni by protons is being determined to aid in interpreting the measurements of helium isotopes in meteorites.

### Cloud Chamber Studies

The ten-atmosphere cloud chamber was used in an experiment at the 184-inch cyclotron for the production of  $\pi$ -minus mesons in deuterium by 340 Mev neutrons. A lithium-deuteride target was used. Over one thousand pictures were taken; they are now being scanned in the stereoscopic viewer, preliminary to reprojection and measurement of the meson events.

The 35-atmosphere diffusion cloud chamber which is now being assembled, has successfully met a pressure safety test at twice the maximum operating pressure. Work is now progressing on an acetone cooling system, and control equipment for operating the chamber is being designed.

### Synchrotron Studies

The main effort during this period has been devoted to the continuation of experiments on  $\pi^-$  mesons produced in deuterium by the  $\gamma$ -ray beam. The  $\pi^-$  mesons are being detected in coincidence with protons and the high energy end of the proton spectrum is being examined in order to ascertain whether any of the spin-flip process is taking place. Preliminary evidence indicates that it is probably rather small in comparison with the non spin-flip process.

Some work has been done in an attempt to determine whether there is any resonant scattering of  $\gamma$ -rays by nuclei. The results so far are inconclusive, but further work is planned with improved equipment.

An experiment is being set up on the Compton effect on electrons. For this experiment an attempt will be made to use a large CsF crystal which Dr. Hofstadter at Stanford has been growing.

Some work has also been done on beam calibration with inconclusive results. There is a discrepancy between the number of quanta per Nunan at high and low beam levels. This may be due to differences in the background affecting the pre-collimator Nunan meter, but experiments have not been able to pin this down.

## 2. THEORETICAL PHYSICS (A. E. C. Program No. 5211)

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### Pion Studies

The production of positive pions by protons scattering on complex nuclei is being calculated for several incident proton energies and meson angles in the laboratory system, using the  $p + p \rightarrow \pi^+ + d$  excitation function and angular distribution.

The calculation of  $\pi^-$  meson production in n-d collisions is being continued as is the calculation of the probability of the neutral meson decaying into two pairs.

### Scattering

The angular distribution for Compton scattering on nucleons is being investigated to determine the effect of nucleon isobaric states.

Field Theory

Work on the Tomonaga intermediate coupling scheme is continuing.

Calculations of the higher order corrections to the reaction matrix for photo-pion production, and the radiative corrections to meson-nucleon scattering in the radiation damping theory are being continued.

Meson scattering and related problems using pseudo-scalar theory with gradient coupling are being investigated. The problem of the scattering of low energy electrons on a Coulomb field is being set up. The possibility of application of Schwinger Green's function technique to meson-nucleon interaction is being investigated.

Accelerators

In connection with the general study of synchrotron beam extraction, estimates have been made of desirable foil thicknesses for use in a scattering deflector. In addition, a study was made of a proposal for extracting the beam by neutralizing it with electrons. It was found that extremely high electron plasma densities would be required.

A report on the calculation of the quantum corrections to the radiation of charged particles in circular orbits has been written.

Work on the alternating gradient focussing reported last month is still in progress.

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

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M. T. A. Target Physics Program

The major effort of the MTA target research group continues to be centered about experiments with 320 Mev deuterons produced by stripping 510 Mev He<sup>3</sup> particles in the 184-inch cyclotron. Although the more typical beam of 320 Mev deuterons out through the steering magnet channel is about  $5 \times 10^{-14}$  ampere, currents as high as  $2 \times 10^{-13}$  ampere have been maintained for short periods of time.

Measurements with the 320 Mev deuteron beam have been somewhat hampered because of the inability to measure currents of the order of  $10^{-13}$  ampere reliably with the vacuum Faraday cup which has been used in the past. This limitation has been removed by the completion of a new vacuum Faraday cup, the main innovation in which is the inclusion in the vacuum chamber closely coupled with the Faraday cup, the electrometer tube and associated grid leak so that only relatively high level currents are transmitted through the external circuits. Tests indicate that beam currents down to  $10^{-14}$  ampere can be measured reliably with this new Faraday cup.

Tests have also been completed on improved ionization chambers used for beam monitoring. The troublesome saturation effect, which has limited the use of ionization chambers to beam currents of only a few times  $10^{-10}$  ampere, has been eliminated by the construction of a new chamber and the use of helium instead of argon as a filling gas.

A preliminary measurement of the neutron yield for 320 Mev deuterons on a thick uranium target (approximate dimensions 12 in. x 12 in. x 10 in.) by the  $\text{BF}_3$  long counter method gives the value  $9.3 \pm 1.0$  neutrons/deuteron. Since past experience indicates that this method inherently gives a low value for the neutron yield, the true value is expected to be at least 10 neutrons/deuteron. As soon as practicable a water tank measurement of the yield will be made.

#### 4. ACCELERATOR CONSTRUCTION AND OPERATION

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

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##### Bevatron Construction

Magnet. By the end of the period approximately twenty percent of the magnet pole base slabs had been assembled and production was proceeding at the rate of about seven slabs per day. All the plates required for the pole bases were received by January 15. The sample batch of 1000 enameled plates for the pole tips has been approved at the manufacturer's plant in Dallas, Texas, and production is starting on the total quantity.

The jacks under the magnet sectors are being adjusted to correct for settling which occurred since the sectors were installed about two years ago. The difference between the highest and lowest point was about 0.4 inches. This is being reduced to about 0.020 inches. A tentative design has been made for a filter to reduce the 12th and 24th harmonic voltages of the magnet power supply. The ignitron is now being reconnected for series operation of the generators. A test is planned in the next few weeks to determine the impedances of the generators to verify the design of the filter. This test will be made without the use of the magnet. Tests on the 7th scale model magnet indicate that the percentage of ripple in the magnetic field will be substantially equal to the percentage ripple in the magnetic current.

Vacuum System. The diffusion pumps were started on the first tangent tank on January 12. Top and bottom panels for the second quadrant tank have been completed.

Accelerator. Testing of the saturable reactors for the accelerating electrodes has been proceeding in the electric shop. The electrode is being designed. The ends of the electrode are adjustable to permit varying the rate of change of the accelerating impulse with radius, which should have an effect on damping the radial or phase oscillation. The d. c. power supply transformer for the accelerator power amplifier is about to go out for bid. Experimental work is proceeding on the system for monitoring the relation between frequency and magnet current.

Shielding. Preliminary plans are being made for shielding to be placed around the outer radius of the magnet. The shielding would be installed in three steps, the first being the minimum known to be needed, which would make the shielding around the tangent areas equivalent to the shielding of the quadrant by the outer legs of the magnet. The other two steps would be taken as experience indicates.

Deflector. Studies are being made on a scheme for deflecting the protons. This consists of a graphite absorber located at the outer radius which would slow the ions down sufficiently to cause them to spiral into a magnetic deflector located approximately three-fourths of the way around the circle from the absorber. The deflecting magnet would then bend the beam sufficiently to cross the center line and come out through a tangent area.

184-inch Cyclotron Operation. (Program No. 5741)

The cyclotron was used for research experiments approximately 96 percent of the 471 hours that the crew was on duty. The time distribution was as follows:

Operation for customers	453.25 hours	96.2 percent
Electrical troubles	3.25	0.7
Mechanical troubles	4.50	0.9
Motor generator tests	2.25	0.5
Maintenance, visitors, etc.	7.75	1.7
Totals	471.00 hours	100.0 percent

60-inch Cyclotron Operation. (Operated by the University of California)

Since replacing the grid feelers  $C_{12}^{+6}$  operation has returned to previously high levels. Long periods of use with this particle and a newly designed source has led to steadier operations at this high level.

Beam levels with alpha particles are considerably lower with the flat feelers as compared to the grids -- most users requirements were able to be fulfilled nonetheless.

The overall operating efficiency has returned to about 80 percent since last months leak repair.

Synchrotron Operation. (Program No. 5731)

The synchrotron continued to operate consistently with high intensity output during this report period.

The electron linear accelerator was put in operation for bombardment by the physics research group.

Operating statistics are as follows:

Operation for customers	229.5 hours	70.8 percent
Tests with synchrotron	53.0	16.4
Maintenance and installation	<u>41.5</u>	<u>12.8</u>
Totals	324.0 hours	100.0 percent

Linear Accelerator Operation. (Program No. 5751)

The total operating time of 326 hours was distributed as follows:

Running time	163 hours	52 percent
Installation of electrostatic lenses	67	20
Repairs	<u>96</u>	<u>28</u>
Totals	326 hours	100 percent

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

CONFIDENTIAL

High Energy Fission of Bismuth

Work has been completed on a fission product yield distribution for fission of bismuth with 340 Mev protons. The results are consistent with the mechanisms proposed on the basis of work at lower energies, except that the increased energy leads to the loss of more neutrons prior to fission. Evidence is found for fission by atoms over a range of mass numbers.

One point of special interest concerns the relative yields of nuclear isomers. In four cases studied, the isomer with the higher spin always had a substantially higher yield than the isomer of low spin.

Decay Schemes

Various values have been reported for the gamma ray energies of Th<sup>230</sup> (ionium). Measurements made here with a scintillation spectrometer give 68 kev, 146 Kev, and 246 kev.

Additional work has been done on the decay of Pa<sup>232</sup>. The decay is complicated, but a reasonable scheme gives a total decay energy of about 1.50 Mev.

Vapor Pressure Measurements

An apparatus is being constructed to perform vapor pressure measurements on heavy-element compounds and metals by the Knudsen effusion method. The apparatus is of twin symmetrical design to permit use of relative measurements.

### Crystal Structure of TbOF

TbOF was prepared by pyrohydrolysis of  $TbF_4$  at  $400^\circ C$ , in a muffle furnace overnight. Powder x-ray diffraction patterns show it to be rhombohedral and isostructural with the rhombohedral forms of YOF and LaOF, with the unit cell dimensions:

$$a = 6.750 \pm 0.010 \text{ \AA}$$
$$\bar{\alpha} = 33.1 \pm 0.1^\circ$$

### Crystal Structure of YBr<sub>3</sub>

Powder x-ray diffraction patterns of  $YBr_3$  indicate that the bromide atoms are approximately in hexagonal closest packing, as they are in  $AlBr_3$ . The yttrium positions have not been determined. Experiments with the growing of single crystals are being made to permit a more complete structural analysis.

### Mass Spectroscopy

The time-of-flight isotope separator has been used to confirm the assignment of the 59 hour ytterbium activity and its 8 hour thulium daughter to mass 166. Experiments are in progress on other rare earth activities in this region.

### Metals and High Temperature Thermodynamics

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Work is in progress on the following problems: refractory silicides, molybdenum chlorides, alkaline earth oxide gases, carbon fluorides, and thermal conductivity of gases at high temperatures.

### Basic Chemistry

The following problems are under investigation: studies involving liquid ammonia as a solvent, thermodynamics of indium, ferric fluoride complex ions, the hydrolytic polymerization of zirconium, thermodynamics of sulfide ion, oxidation-reduction chemistry of  $RuO_4^-$ ,  $RuO_4^+$  and  $RuO_4$ , study of hydrates, thermodynamics of thiosulfate, and bromate thermodynamics.

### Health Chemistry

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

1. Work was completed on the equipment for processing the first high-level bombardment from the Idaho Falls reactor. A general description of the setups in the six-inch and 2-inch caves was given in the Quarterly

Progress Report for July through September, 1952. During this period the following items for use in these caves were completed: three boxes for use in the six-inch cave; four boxes for the two-inch caves; slug opening equipment; the second set of uranium balls and sockets; box ventilation systems for the six-inch cave boxes; syringe systems for the chain-drive manipulator in the six-inch; two-piece tongs for use in the six-inch; dissolver box assembly (six-inch); column systems; heaters; motor-driven bottle slides; hot water heat exchanger; spiral socks for tong shafts; centrifuge setups for both type caves; electric power for all seven boxes (the total number of boxes in the six-inch and four two-inch caves); special lead caves in each box in the six-inch cave; rotating reagent racks for the six-inch boxes; samplers for the two-inch caves; turntable assemblies; transfer boxes and tongs (two-inch cave); tong finger adapters; syringe holders; spot heater holders; sample holders; new transfer box door system for the six-inch setup; and dolly docks for boxes in the six-inch cave.

2. The one-hundred-twenty curie cobalt source, completely set up in its permanent housing last month, has been tested as to the strength of its radiation field. The initial reading gave  $3.9 \times 10^5$  r/hr at the maximum setting. Further tests will be made.
3. Special equipment has been completed for boxes being fabricated for use in Livermore.
4. A box assembly for processing a bombarded ionium sample, from Idaho Falls, was completed.
5. Further work has been done on improvements on 60-inch target assemblies and preparation of same for use has been completed.
6. Fourteen gloved boxes were prepared and fitted for use on request.

One hundred eighty-five active waste drums and 5 "blocks" (gloved boxes cemented into single units) were disposed of at sea; this quantity required two sea trips.

6. BIOLOGY AND MEDICINE  
(A. E. C. Program Nos. 6300-6500)

Nucleic Acid Studies

The effect of single and multiple doses of estradiol benzoate on the incorporation of P<sup>32</sup> into desoxypentose nucleic acid (DNA) of various rat tissues, and pentose nucleic acid (PNA) of liver is being investigated. A single dose of 2 mg. of estradiol benzoate administered intramuscularly ten days prior to the injection of P<sup>32</sup> showed the following results: The incorporation of P<sup>32</sup> into nucleic acids produced a marked increase in the DNA of liver and kidney, no change in the DNA of thymus and spleen, no change in either the nuclear or cytoplasmic PNA of liver, and a definite decrease in the DNA of bone marrow. The same amount of estradiol administered in multiple doses over a period of ten days showed similar effects, with a much more marked increase in the liver DNA, a slight increase in the cytoplasmic PNA, and a slight depression in nuclear PNA. The liver weights taken as percentage of body weight were increased both with the single and the multiple injections.

Chromic Phosphate Studies

In the interest of quantitating the effects of specific regional irradiation, an experiment was undertaken with radioactive colloidal chromic phosphate which has been shown to localize to the extent of 98 percent in the liver and spleen of the mouse following an intravenous injection. The chromic phosphate was prepared with radioactive phosphorus (P<sup>32</sup>) which provided the irradiation.

Varying quantities ranging from 25 to 300 microcuries of activity were injected via the tail vein into ten groups of ten mice each. The body weight loss and survival were used as an index of the radiation effect.

The critical dose seems to lie in the region of 75 to 100 microcuries per mouse. Above 100 microcuries per mouse the animals progressively lost weight and finally died. Below 75 microcuries per mouse those animals which survived gradually regained the lost weight. The livers of the survivors, however, showed tremendous damage which was apparently repaired by regeneration producing a typical hobnailed appearance so common in cirrhosis.

The liver blood flow was measured on two of these badly damaged but regenerated livers before sacrificing the animals. The liver circulation was found to be strikingly normal.

Histological sections have been prepared at all stages of this irradiation but have not yet been examined.

### Iron Turnover Studies

The blood and plasma serial radioactivity curves in several of the recent iron turnover determinations have been done by the use of many, small, early samples. These data provide interesting mixing curves. The Fe<sup>59</sup> globulin is a natural protein labeled with a convenient gamma ray. Samples of whole blood and plasma are separately and easily assayed for radioiron. Comparison of the early portions of such time concentration curves with those of sodium<sup>24</sup> and cobalt<sup>60</sup> (as Co<sup>60</sup>B<sub>12</sub>) indicates, as expected, that no diffusion out of the vascular bed occurs. The extrapolation of the major decaying exponential component after mixing is facilitated for use in determination of the plasma volume.

Some experiments with ethylene-diamine-tetra-acetic-acid (with especial affinity for iron) have disclosed that suspension of erythrocytes in 2 percent solution results in no hemolysis. Red cells containing radioactive iron in hemoglobin lost none of their radioiron to the ethylene-diamine-tetra-acetic-acid in the supernatant. This chelating agent was unable to detach and complex iron bound to the  $\beta_1$  globulin in the pH range of 6.5 - 7.5. Iron already complexed to ethylene-diamine-tetra-acetic-acid did not develop the characteristic pink complex with  $\alpha, \alpha'$ -dipyridyl. Iron already in  $\alpha$ -dipyridyl complex was not decolorized by addition of ethylene-diamine-tetra-acetic-acid.

### Tracer Studies

Studies upon the relative biological effects of beta and alpha emitters are being continued. Work upon the deposition of aerosols in the lungs of primates is under way. The ability of Versene to remove curium from rats is being investigated.

### Radioautography

Things are being organized for all that came out of the Astatine<sup>211</sup> study.

### Radiation Chemistry

Studies of the radiolysis of aqueous acetic, amino acetic and formic acids are being continued.

### Organic Chemistry

The research which has been performed in this field during the past month has included (1) studies on the isotope effect involved in the rearrangement of methyl-labeled pinacol, (2) work on the chemical degradation of ribulose and sedoheptulose, (3) a large-scale synthesis of  $\Delta^7$ -cholestenol, (4) the chemical actinometry of a Co<sup>60</sup>  $\gamma$ -ray source, (5) studies on methods to synthesize carbon-labeled 6,8-thioctic acid, morphine, codeine, cholic acid and heptanoic acid, and (6) determinations of the extent of radioactive decomposition which takes place during the storage of C<sup>14</sup>-labeled compounds.

Animal Biochemistry

In the field of animal biochemistry, research is in progress on (1) the metabolism of adenine in mouse liver slices and (2) the effect of heparin on the rate of metabolism of fatty acids and other compounds.

Plant Biochemistry

Studies on the nature of the processes of plant photosynthesis are continuing. During the past month research in this field has been focused upon (1) investigations designed to determine the connection between pyruvic acid oxidase factor (thioctic acid) and the primary light-energy conversion step of photosynthesis, (2) a search for photosynthetic intermediates, (3) separation of phosphorus-containing algae metabolites and measurement of the distribution of radioactivity in these compounds, (4) attempts at improvement of paper-chromatographic techniques in photosynthesis research, (5) chemical degradations of plant sugars, (6) studies of the effect of thioctic acid upon the rate of the Hill reaction and (7) determinations of the chlorophyll-sulfur ratios in various green algae constituents.

7. PLANT AND EQUIPMENT UNCLASSIFIED

Miscellaneous Construction. (Project No. 9300. 3-271-3001)

Computer Facility - Building 100. The building is 78 percent complete and is due to be finished by February 1, 1953. The Univac will be delivered soon after February 1, 1953. Sprinkler System - Bldg. 153 - 96 percent complete. Electrical Distribution System - Bldg. 153 - Power 100 percent complete - lighting 76 percent complete. Pits No's. 1 and 2 near Bldg. 153 - 20 percent complete. Mechanical Utilities System - Bldg. 161 - 95 percent complete.

Bevatron Instrument. (Project No. 9500. 5-271-9001)

Thirty percent of the pole bases have been fabricated. Top and bottom panels of second curved tank are complete as well as the top panel of the third tank. The east tangent tank has been permanently installed, and the second tank is due January 21, 1953. Four transition tanks have been vacuum tested. The acoustic shrouding has been installed on generators.

Synchrotron Research Building. (Project No. 9500. 5-271-2001)

Building is 100 percent complete and is fully occupied.

Chemistry Laboratory Building. (Project No. 9500. 5-271-1002)

The architects are awaiting the mechanical engineering consultant's section of work before completing the plans; the plans should be finished by February 1, 1953.

Electronics Research Building. (Project No. 9500. 5-271-2002)

Negotiations are underway with an architect.

Miscellaneous Construction. (Project No. 9500. 5-271-2002)

Fireproofing the 12 kv line from Campus - 90 percent complete.  
Increase in Calgon pumping capacity - 80 percent complete.

MAN-MONTHS EFFORT REPORT  
SCIENTIFIC PERSONNEL

Program No.	Subdivision	Man-Months Effort	Comments
9300	Construction Miscellaneous	2.85	
9500	Construction General	9.10	
<u>Operations</u>			
2000	M. T. A. Design and Development	18.80	
3000	Weapons Research General	103.81	
5211	Physics Research Experimental Physics Cloud Chamber General Physics Research Instrument for General Use Magnetic Measuring	11.40 46.05 6.97 3.03	
	Theoretical Physics General	14.53	
	Photographic Film Detectors General	12.85	
5261	Applied Physics Research Electron and X-C Models	1.68	
<u>Chemistry Research</u>			
5311	Basic Chemistry Research Part A Chemistry of Heavy Elements Nuclear properties of Heavy Element Isotopes Transmutations with 184-in. and 60-in. Cyclotrons	2.61 8.25 4.61	

MAN-MONTHS EFFORT REPORT

SCIENTIFIC PERSONNEL

Program No.	Subdivision	Man-Months Effort	Comments
5311 Basic Chemistry Research, Part A (Contd.)	Analytical and Services	16.92	
	Special Chemistry Development	0.81	
	Mass Spectroscopy, Beta Ray Spectroscopy	1.40	
	Instrument Development and Services	3.60	
	X-ray Crystallographic Measurements	2.20	
	Health Chemistry Research	5.02	
	Radiation Chemistry	0.81	
Part B Basic Chemistry Research	Metals and High Temp. Thermodynamics )		
	Basic Chemistry, including Metal Chelates ) General	6.50	
5361 Applied Chemistry Research	Process Chemistry	4.83	
Reactor and Accelerator Operation			
5731 Electron Synchrotron	Operation	4.10	
5741 184-inch Cyclotron	Operation	7.35	
5751 Linear Accelerator	Operation	16.51	
6300 Biology and Medicine	Health Medicine	-	
	Metabolic Ward	-	
	Internal Irradiation	6.60	1.56 Consultant
6400 Biological Research	Miscellaneous	3.80	0.73 Man -
	Instrumentation	2.06	0.37 Months
	C14 Metabolism	3.59	0.19
	Use of Radioactive Material in Human Physiology	12.62	3.98
	Trace Elements	2.76	0.42
	Physical Biochemistry	11.99	3.35

MAN-MONTHS EFFORT REPORT

SCIENTIFIC PERSONNEL

Program No.	Subdivision	Man-Months Effort	Comments	
6400 Biological Research (Contd.)	Biochemical Response to Radiation	3.75	0.42	
	Metabolism of Lipo-proteins	4.97	11.25	
	Iron Metabolism Hematopoiesis	3.24	0.36	
	Biological Effects of Cosmic Radiation	2.10	0.10	
	Radiation and Mutation Rate	1.48	0.23	
	Bio-organic Chemistry	22.68	-	
	Metabolism of Fission Products	16.26	-	
	Animal Colony	3.11	2.76	
	6500 Biophysics Research	Health Physics	1.75	-
		Irradiation Studies	3.05	0.54

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