



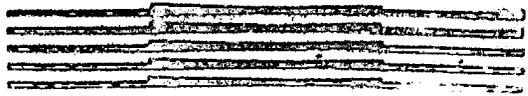
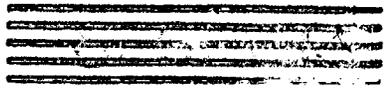
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RADIATION LABORATORY



UCRL-1661
C.R.

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UNIVERSITY OF CALIFORNIA

Radiation Laboratory

Contract No. W-7405-eng-48

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MONTHLY PROGRESS REPORT
No. 105

December 15, 1951 to January 15, 1952

February 4, 1952

~~RESTRICTED DATA~~

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UNIVERSITY OF CALIFORNIA, RADIATION LABORATORY

December 15, 1951 to January 15, 1952

MONTHLY PROGRESS REPORT No. 105

February 4, 1952

1. Bevatron
(AEC Program No. 9500)

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Magnet coil winding was stopped during the period due to failure of the suppliers to furnish coil spacers and interference from other work in the building. Spacer production is now going again and it is hoped that winding can be resumed about February 15.

2. 184-inch Cyclotron Operation
(AEC Program No. 5741)

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The cyclotron was used for research experiments approximately 92 percent of the 517 hours that the crew was on duty. The time distribution was as follows:

| | | |
|-------------------------|-------------|---------------|
| Operation for customers | 474.0 hours | 91.6 percent |
| Electrical troubles | 12.5 | 2.4 |
| Mechanical troubles | 27.0 | 5.3 |
| Filament changes | 2.0 | 0.4 |
| Visitors | 1.5 | 0.3 |
| Totals | 517.0 hours | 100.0 percent |

3. 60-inch Cyclotron Operation
(AEC Program No. 903)

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Work has been continued on the beam envelope patterns and magnetic field plots. Indications are that the theoretical point of $n = 0.2$ is being reached at 23-1/2 in. on the south side causing the envelope blow-up at 22 in. on the north side.

The general operation level of 80 per cent has been maintained with all requirements of users being met for α , H_2 , and D_2 particles.

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Carbon acceleration is still being worked on to increase both intensity and maximum beam energy.

4. Synchrotron Operation
(AEC Program No. 5731)

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Beam intensity has been improved during this report period. However, it still is down by a factor of two from our average of several months ago. The beam intensity is still dependent on the injector being used.

An interesting possibility is being investigated, namely, how well the ground shield on the injector is kept at ground potential. If the ground lead forms a loop in taking up the slack, there could be considerable inductance in this lead. This inductance of the grounding lead would allow the ground shield to rise in voltage with the filament high voltage pulse. A new grounding system is waiting trial.

Work is continuing on the 3 Mev injector, but many parts have not yet been received from the shops.

5. Linear Accelerator and Van de Graaff Operation UNCLASSIFIED
(AEC Program No. 5731)

During this month it became evident that premature oscillator tube failures were occurring. Examination showed that some of the associated oscillator protective equipment was not functioning properly, and that some additional protective equipment should be installed. The relatively large maintenance time for this month was used principally in the reworking of these circuits. Also during this period, representatives of the tube manufacturer were brought in and they made recommendations regarding operating procedures which should help materially in reducing future tube failures.

| | | | |
|-------------|--------------|-------------|--------------|
| Statistics: | Running time | 117.5 hours | 40.7 percent |
| | Repair time | 142.5 hours | 49.5 percent |
| | Maintenance | 27.0 hours | 9.8 percent |

6. Experimental Physics
(AEC Program No. 5211)

UNCLASSIFIED

Film Program. A new scattering chamber or camera has been readied for use in observing proton scattering by passage through foils, using nuclear emulsion plates for detectors. The vessel is evacuated and is designed to operate in the cave with the deflected proton beam. It can also be used with the neutron beam or with electron or photon beams. Considerable care has been exercised to improve the angular resolution obtainable. An experiment to observe the diffraction scattering of protons is contemplated.

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The most recent experimental run to measure the π^+ and π^- meson masses has yielded plates from which more accurate mass values should be obtainable. The background in the plates is high, however, and the work of reducing the data is expected to take a considerable amount of time.

Cloud Chamber. The large iron core magnet for the cloud chambers has had a new magnetic field check with 1/2 inch of iron removed from the pole piece. Also, a project is now in progress for improving our thermal regulation in the magnet gap.

The film reading for the experiment on Helium stars produced by 90 Mev neutrons is practically completed. Calculation and reduction of the data are now well under way.

A new space table for reading film is being designed. It is hoped that some of the errors introduced by the operation of the old table - e.g. in measurements of angles, heights, and distances - can be reduced. This, in combination with the new magnetic field measurements, should improve the accuracy and speed of the whole process of film reading.

Elastic Proton-Deuteron Scattering using 345 Mev Protons. Theory shows there should be some inelastic scattering processes that look very much like elastic scattering in that in the final state a neutron and proton are left with very little relative momentum. Some changes in the experimental arrangement are being made to keep these processes from contributing to the elastic scattering measurements. This means being sure that the deuteron counter cannot be actuated by a proton of half the expected deuteron energy by interposing a proper absorber.

Proton-proton Scattering at Reduced Energies (160 to 250 Mev). Although the target was satisfactory when first assembled, it developed leaks after many evacuations, and a new liquid hydrogen flask was designed and is being built. These steps involve some delay not previously anticipated.

Proton Scattering. Work on the scattering of 30 Mev protons from Be^9 has continued. Previously reported results do not seem to be substantiated so it is concluded that conclusive evidence for new levels in Be^9 at ~ 4 and ~ 6 Mev does not exist.

The Photoproduction of Negative Pions from Deuterium. A short run during the past month was devoted to the study of improving the collimation and shielding in order that this experiment could take advantage of the higher synchrotron beam intensity. The preliminary results look encouraging. The "singles" counting rates were reduced by additional shielding. It may be possible to increase the counting rate by using a slightly larger collimator.

The angular correlation of pion-proton coincidences was demonstrated by moving the pion telescope. Previous results were obtained by moving the proton telescope.

Neutral Mesons. Targets of lithium, beryllium, isotopic boron 10, boron, carbon, sodium, and potassium were bombarded with 340 Mev protons in the deflected beam of the 184-inch cyclotron. Relative yields of high-energy γ - rays were measured with the scattering detector reported earlier. The yields

were extrapolated to zero beam intensity as given in an earlier report. The yields obtained for B10, B, and C are in essential agreement with earlier runs. The yield from Be appeared to be 25 percent higher than previous data indicated. This remains to be verified. The yields of Li, Na, and K show a yield proportional to nuclear volume for the nuclei smaller than Na, with smaller yield per nucleon for the K target.

Lead targets of thicknesses from 0.034 in. to 1/4 in. were bombarded. Results showed no effect of conversion of the γ -rays in the target for thicknesses of 0.070 in. and less. It appears feasible, then to make a yield comparison to carbon by using Pb targets of 0.034 in. and proton beam currents of 10^{-10} ampere and less.

Charged Meson Production by 280 Mev Neutron Beam. Since November 12, 1951, additional work has been done on the measurement of the ratio of charged mesons (π^-/π^+) produced at 90° to the 280 Mev neutron beam on C^{12} and Be^9 . The measurements are

$$(\pi^-/\pi^+)_{Be^9} = 30 \pm 10$$

$$(\pi^-/\pi^+)_{C^{12}} = 10 \pm 2$$

The carbon ratio previously measured by us was 17 ± 9 . The meson energy was 50 ± 10 Mev. The total charged meson production from carbon was examined at 135° , 90° and 30° . The relative cross sections are 1, 4, and 20. Our counting rate at 135° is about 1 per 8 minutes. Further work is planned for angles less than 30° . In the region 0 to 30° , the counting rate should be sufficiently large to measure π^-/π^+ ratio from various targets.

Nuclear Elastic and Inelastic Scattering of 300 Mev Neutrons. Some preliminary runs have been made with both the elastic and inelastic neutron scattering apparatus. An effort is being made to reduce the excessive background found to be present in the elastic experiment.

Synchrotron Studies. The month of December 15 to January 15 was somewhat broken up by the holidays, but several things in the line of synchrotron experiments were accomplished. The experiment on the difference between pair production cross section of Be and the total cross section for Be at high photon energy has been completed. It will be reported in UCRL-1654. The accuracy in the final determination is, however, too large to ascertain that the difference is significantly at variance with the cross section calculated from the Klein-Nishina formula. Perhaps further work can be done on this project.

The experiment on the π^+/π^- ratio has advanced. Most of the data at two angles (90° and 135°) have been obtained. The apparatus has been moved in closer to the synchrotron. It still utilizes a magnetic field, this time of a small magnet, to separate the two types. Reversing the magnetic field allows a check of the data.

Because of the recent theoretical work on the radiation from the accelerated electrons in the synchrotron orbit, an experiment has been made showing that the predicted total radiation loss is correct. The experiment involves turning off the radiofrequency voltage at varying times after the peak of the

magnetic field has been reached, and determining at what time or energy the radiation loss is not sufficient to cause the electron to spiral in to hit the target.

Work on the π^- production from deuterium has continued, and with good operation, should be completed in a few weeks. Work on the π^0 production from deuterium is also being continued.

7. Theoretical Physics
(AEC Program No. 5211)

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Work reported earlier on the p-p scattering cross section calculations using a tensor interaction cut off with a square well at short range is continuing. The calculations have been extended to include polarization effects in double p-p scattering using the same interaction.

An attempt is under way to formulate the concept of effective range in the presence of tensor forces in a way which can readily be applied to practical calculations. The work reported last month on high energy deuteron photodisintegration is being interpreted and extended. An effort is being made to see if one can interpret the most interesting recently observed general features of meson-nucleon scattering in terms of radiation damping rather than as consequence of the existence of a nucleon isobar. Work reported last month on neutral meson production in deuterium is being extended to the more general case in which the final state is unbound, and to the determination of the total cross section.

A general program of calculation is being considered in which one would attempt to fit low, medium, and high energy data on n-p forces with a potential of the form prescribed by pseudoscalar meson theory, but modified in an empirical way at very short ranges (e.g., by an infinitely repulsive core). As a first step in this direction, an entirely phenomenological study of n-p and p-p scattering is being started, using a repulsive core and a $1/r^3$ attraction.

Work previously reported on elastic scattering of π^- mesons on carbon is still in progress. A calculation is being made of the internal energy and density of liquid helium.

An examination of the nuclear force problem using pseudoscalar meson theory with pseudoscalar coupling, in the weak coupling approximation, has led to analytic expressions for the potentials which show that the nuclear force is equivalent to a strong spin-independent attractive force plus a weaker spin-dependent tensor force. The strong ordinary force is identical in form to the force expected in a scalar pair theory of nuclear forces. In addition, work is under way on a strong coupling non-relativistic form of the pseudoscalar theory which leads to a non-linear term in the coupling between mesons and nucleons.

The calculations of diffraction and total scattering cross sections of protons and neutrons on various elements in the energy range from 25 to 350 Mev is nearing completion. These calculations are based on the optical model of a nucleus with a diffuse surface layer, but embody corrections not previously applied to this model in that at low energies the phase shifts have been actually calculated and summed.

8. M.T.A. Program
AEC Program No. 9500

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Mark I Drift Tubes. It was necessary to return the number four Mark I drift tube to Berkeley for repairs when it was found that about one-half gallon of electrolytic cleaning solution had leaked into the space between the copper shell and the magnet. Inspection revealed that the drift tube surface had several pin holes and cracks at places where welding and subsequent polishing had been done. During the drift tube cleaning operation an attempt had been made to maintain a one pound positive pressure of nitrogen gas in the space between the copper shell and the magnet. Since a leak has now been located in the region where the drift tube stem and drift tube magnet are connected it is thought that insufficient positive pressure was maintained. To prevent a recurrence of the trouble, a pressure cap will be placed over the relief valves and a nitrogen pressure of three pounds per square inch maintained. The copper shells will then be etched with nitric and acetic acids, checked for damage, repaired, and given a final cleaning. Since this added operation will increase the cleaning time, the last drift tube is not expected to be shipped to Livermore until February 1.

Mark I Oscillators and Pre-Excitors. Thirteen oscillators have been tested at high power, but are not ready for shipment until a water circuit for the grid suppressor rings has been installed. Three oscillator tubes are being returned to RCA because of excess grid vibration. Upon receipt of three new tubes, eighteen will be on hand and in good condition, which is sufficient to start operations. The Navy is reported to have twenty-four tubes of this type currently not being used and it is thought that these could be obtained if no more are available from RCA. The redesigned pantograph assembly to reduce the mechanical vibration on the grid support structure has been installed on one tube. Both of the pre-excitors have been tested and found to be in good condition. The pre-excitors and transmissions lines have been shipped to Livermore. The rf crowbar equipment has also been completed.

Mark I Injector. Work on the injector for Mark I has been completed and in tests has given a 750 milliamper beam for two hours. This model held the required 80 kilovolt immediately with little bake-out time as compared with the original model where over two weeks work was required before this voltage could be held. The present model uses a mercury diffusion pump system in place of oil diffusion pumps. The replacement of oil with mercury eliminates all oil vapor which was thought to be responsible for the original problems.

Mercury Diffusion Pump Tests. All of the mercury diffusion pumps have been returned from Distillation Products Incorporated and the first one has been put into operation. A large quantity of dirt was found inside this pump which necessitated cleaning it. The first pump was tested after cleaning and found to produce the correct pumping speed but not the specified base pressure because of some impurity in the mercury. The second converted pump after cleaning reached a speed when cooled with 15° C water of 2800 liters per second at 1×10^{-4} mm mercury pressure with a base pressure of 3×10^{-7} mm of mercury.

Transmission Line Problems. Several problems have arisen which necessitate removing the installed transmission lines. The loop ends of the transmission lines had originally been designed with blocks of copper attached to permit adjusting the voltage picked up from the cavity field. It has been decided to

remove the blocks to obtain the maximum power from each oscillator. The copper plating on the bolts that fasten the pickup loops to the transmission lines flake off under the bolt head. Since the bolts in this condition become red hot during operation, the edges will be rounded and replated. Furthermore the Myvaseal vacuum gaskets on the loop ends of the transmission lines were found to leak so that it was decided to change to Hycar gaskets. Lastly there is the problem of the unlubricated 20 inch rotating Teflon gasket vacuum seal on the pre-excitor transmission line now under test. It is found that this seal will function properly for the first 100 operations and then begin to flake off, causing vacuum leaks. Since some heating is present at the seal, the water cooling system will be connected to determine whether or not the flaking is temperature dependent.

Distilled Water System. At present some trouble is being created by high conductivity in the distilled water system. The main impurity seems to be calcium. Since high conductivity in the cooling system may cause trouble in the drift tubes and ion injector, it is felt that this impurity should be removed. This may be done by the use of an ion exchange by-pass column.

X-ray Problem. After cleaning the sphere in the B-1 cavity with a white cotton glove the x-ray level was reduced by a factor of 250 over previous results when the cavity was loaded to 2.15 million volts. The sparks occur at a rate of about one every one or two minutes. It is felt that the removal of the dust by the cotton glove was mainly responsible for this large reduction in x-ray level. It has also been noted that copper surfaces oxidized by water and gas-oxygen flame give extremely low x-ray levels and a low rate of sparking when used in a high voltage cavity. If this treatment is successful in the B-1 cavity, another method will have been found to control the x-ray production.

Long Drift Tube Model Studies. Work has been started on the model for the long drift tube tests. The gap splitters will be designed with smooth surfaces, having provision for the attachment of ridged plates to study the effect on electron multipactoring.

Ion Pump Development. A new ion pump was assembled ready for installation in the B-1 cavity. A new effect has been noted in the operation of ion pumps. If air at 1,000 liters per second and 10^{-5} mm pressure is admitted with the fore pump closed off, no increase in pressure is noted. If argon is admitted under these conditions the pressure rises instantly. Selective gas absorption is thought to account for this effect.

A preliminary ion pump design has been made for Mark II. A helix will be placed inside a vacuum manifold system, which is suspended directly below the main vessel. Two exit tubes leave from either end of the manifold. Both the helix and exit tubes will have a common center. Surrounding the exit tubes will be solenoid magnets. The arc plasma will flow through both tubes and helix. Since each pump would have an expected speed of 50,000 liters per second, 40 pumps would be required to obtain a speed of 2×10^6 liters per second. Approximately 12,000 kilowatts of power will be needed with very little or no liquid nitrogen for cooling. There will be no baffles or valves between the pumps and the tank.

A-12 Beam Profile Studies. Since the quoted peak to average beam intensity ratio of 33 to 1 is only an estimate, the electron model is being readied to study the beam profile problems of the A-12 accelerator. The beam from the model will be sent through a series of focussing magnets placed consecutively behind the beam exit to simulate the magnetic fields produced by the A-12 drift tubes. It is thought that a reduction in the peak to average intensity ratio can be obtained by offsetting the centers of the magnets. If it is still found to be required, electromagnetic beam sweeping will be applied.

9. Chemistry

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Part A

(AEC Program No. 5311)

Crystal Structures of Rare Earth Oxychlorides. Oxychlorides of the rare earth elements have been examined by x-ray diffraction. From lanthanum to erbium, the structure is like that of $PbFCl$; the lattice parameters of the tetragonal unit cell have been determined.

The oxychloride of erbium is dimorphic, and its second structure is the same as those of $TmOCl$, $YbOCl$, and $LuOCl$. This structure has not yet been solved. The structure of $YOCl$ is the same as that of $LaOCl$.

X-ray Spectrum of RaD. The x-rays from RaD have been studied with the bent-crystal spectrograph. Seven lines were resolved among the L x-rays, besides several gamma rays. These x-rays are interesting in that vacancies in the L_1 level are important, whereas such vacancies were not observed at all in our previous work in the transuranium region.

Alpha Fine Structure in the U^{230} Series. A sample of U^{230} has been examined in the magnetic alpha spectrograph. U^{230} showed two alpha groups separated by 69 ± 3 kev, with 23 percent in the lower energy group. The daughter Th^{226} showed two groups separated by 115 ± 3 kev, with 22 percent in the lower energy group. No complex structure was noted in Ra^{222} and Em^{218} . All results to date indicate some regularity in the alpha fine structure as a function of mass, and more data are being sought to test this regularity.

Radiations of Ra^{226} . The magnetic alpha spectrograph has been used to make a precise measure of the abundance ratio of the two alpha groups of Ra^{226} . The result is that 5.51 ± 0.04 percent of the alpha particles are in the low energy group, compared with 4.8 percent by the pulse analyzer and 6.5 percent by the French workers.

Alpha Electron Coincidences. The study of electron alpha coincidences by the photographic emulsion technique has been extended to include Pu^{239} , U^{236} , U^{230} , and Sm^{147} .

Properties of Ni^{56} . Ni^{56} has been produced by bombardment of iron with helium ions. The gamma ray scintillation pulse analyzer showed four gamma rays, of energies 140 kev, 480 kev, 770 kev, and >1.4 Mev. The best value of the half-life is 6.0 ± 0.5 days. This work confirms the previous observation of the activity in 340 Mev proton induced spallation of zinc.

C¹¹ From Spallation of Copper. The yield of C¹¹ in copper bombarded with 340 Mev protons corresponded to 0.033 millibarns, in agreement with work elsewhere. However, a bombardment with 50 Mev protons yielded even more C¹¹, indicating strongly that at least some of the C¹¹ is due to an impurity in the copper. An impurity of 0.02 percent carbon would be sufficient to explain practically all the C¹¹ produced at both energies. This problem is being studied further.

Chemistry
Part B
(AEC Program No. 5311)

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Metals and High Temperature Thermodynamics. Work is in progress on the following problems:

1. Gaseous hydroxides.
2. Thermal conductivity of gases at high temperatures.
3. Refractories.
4. Gaseous molecules.
5. Gaseous oxides.

Basic Chemistry. The following problems are under investigation:

1. Thermodynamics of rhenium.
2. The hydrolytic polymerization of zirconium.
3. Germanium chemistry.
4. Electron exchange rate between Fe²⁺ and Fe³⁺.
5. Thermodynamics of indium.
6. Thermodynamics of thiosulfate.
7. Solubility of the rare earth fluorides.

Chemistry
Part C
(AEC Program No. 6400)

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Organic Chemistry. Studies in organic chemistry have continued with work on the preparation of labeled amino acids, steroids, and drugs. Reaction rate and mechanism studies have been carried out as a fundamental and necessary adjunct to the more applied biological studies. A series of investigations is underway on the effects of high energy radiation on organic and biological systems.

Animal Biochemistry. An extensive program in biological research has been carried out with the labeled compounds thus prepared, both by ourselves and in cooperation with other groups. Representative of the studies in progress are: 1) the chemical role of cholesterol and allied compounds in heart disease and body metabolism, 2) the metabolism of glycine-2-C¹⁴ in man, 3) the conversion rate of labeled organic compounds as an assay tool for drugs, hormones, and enzymes, 4) the excretion pattern of analgesics in normal and addicted humans.

Plant Biochemistry. The mode of utilization of light energy for the fixation

and reduction of atmospheric carbon dioxide by green plants is being attacked by several different methods. The current work involves studies on the role of the following compounds in the animal system, ribulose and sedoheptulose, heptose phosphate, pentose phosphate, 4-carbon compounds such as erythrose and erythronic acid, and 2-carbon compounds needed in the biological cycles. Other problems of current interest include radioautography of single cells, kinetics of formation of photosynthetic intermediates, radiation effects on photosynthesis, micro absorption spectroscopy, and a comparative study of photosynthesis patterns for a wide variety of botanical classifications.

10. Medical Physics

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Part A

(AEC Program No. 6000)

Tracer Studies. Studies showing the effects of the chelating agent, Ca EDTA, are being continued in rats who receive simultaneous injections of plutonium in the +6 state.

Radioautography. The experimental stripping emulsion was received from Eastman Kodak. Work is in progress to investigate its properties, using the plutonium lung sections as an activity source.

Radiation Chemistry. The products from the radiation induced oxidation of C-14 labelled acetic acid are being identified. Succinic acid has been identified as the principal non-volatile product. Evidence has been obtained which indicates that glycolic acid is also produced. Work is underway on the identification of the other acid products. Work has continued on the identification of the products, in addition to oxalic acid previously reported, obtained in the bombardment of C-14 labelled formic acid in hydrogen saturated solutions. The mechanism of the radiation of carbon dioxide in ferrous sulphate solutions has been studied and further information will be forthcoming.

Medical Physics

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Part B

(AEC Program No. 6000)

The Biological Effects of Radiation with the 184-inch Cyclotron. Partial body irradiation experiments carried out on white rats in collaboration with the U. S. Naval Radiological Laboratory have been analyzed and partially completed. Manuscripts are in preparation on the following aspects of the work.

Lethal effects of localized irradiation of Sprague Dawley rats. Conclusions are that: (1) The abdomen is markedly more sensitive than the remainder of the body if weight loss and mortality are used as criteria. Variation in mortality response is considerably greater than is observed with whole body radiation. (2) The lethal dose of radiation when directed to small volumes of tissue is in general considerably higher than that for whole body radiation. (3) Internal structures cannot be localized accurately from external landmarks. (4) The syndrome of acute whole body radiation injury cannot be produced by even very

high doses of radiation to any small portion of the body (gut, adrenals, etc.). (5) There is no evidence of a particularly radiosensitive region of the abdomen, if mortality is used as the criterion of sensitivity. (6) In general, a greater volume of gastrointestinal tissue irradiated is associated with a lower lethal dose. Direct reciprocity, however, apparently does not exist. (7) Local irradiation of the spinal cord with doses exceeding approximately 2000 rep results in paralysis of the hindquarters within 2 to 3 months of irradiation. Tissue sections reveal no perceptible damage to the vascular structures and the damage to the nervous tissue is presumably primary.

Bowel tumors resulting from deuteron irradiation. It was found that approximately a 2,000 rep dose of deuterons delivered laterally to intact non-anesthetized animals in a small cylindrical beam 5/8 in diameter resulted in extensive chronic ulceration which within 5 months after the irradiation lead to the formation of easily palpable nodular discreet annular tumors in approximately 80 percent of the surviving animals. A new experiment has been undertaken during the past month to determine whether or not the tumors are malignant and to study possible metastases transplantability, etc.

Indirect Irradiation Effects. Several types of indirect irradiation effects have been observed chiefly on the spleen, thymus, and adrenal of irradiated animals as well as in the differential white blood counts. These indirect effects are chiefly indicative of the similarity of indirect radiation effects to the well known "stress" reaction.

Study of Radiation Effects on Microorganisms. Work with the biological effects of radiation on the yeast cells is being continued.

Biological Use of the Six Times Ionized Carbon Beam. Work is being continued on this project.

Instrumentation. The gamma ray pinhole camera was used to resolve the two lobes of the thyroid gland in an adult rabbit. The picture was taken after a dose of 20 millicuries of radioactive I^{131} . Attempts are being made to increase the sensitivity of this instrument by recording the gamma rays in a bank of miniature Geiger counters, each of which is connected to an individual neon tube. Each pulse in a Geiger Muller counter causes a single flash of the neon which in turn can be photographed. At the present stage of the work characteristics of small counter tubes of various design are being studied.

Increased Desoxyntose Nucleic Acid Turnover Rate Produced by Tissue Extracts. In experiments reported earlier from this laboratory (Kelly, L. S., et al. Cancer Research 11, 694, 1951) it was found that the presence of a rapidly dividing tissue mass such as a transplanted neoplasm or an embryo increases the desoxyntose nucleic acid turnover rate in other tissues of the host. This was interpreted as evidence of the release of a humoral agent by rapidly dividing tissue which increases the rate of cell division in the normal tissues of the animal.

In recent experiments the same increase in the nucleic acid turnover rate has been produced by the repeated intraperitoneal injection of embryo and liver extracts. A preliminary experiment has shown that embryo extract given after irradiation relieves the pronounced depression of the desoxyntose nucleic acid

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turnover produced by x-irradiation and thus may help the animal recover from radiation damage. It is suggested that the mechanism of the protective effect of spleen shielding discovered by Jacobson et al. (J. Lab. Clin. Med. 35, 746, 1950) might be via this same humoral agent. Experiments are now under way to fractionate the tissue extracts in an attempt to isolate the active principle. From various observations reported in the literature and from our own preliminary results with nucleotide injections it appears that nucleoproteins or their breakdown products might prove to be the humoral agents involved.

11. Health Chemistry
(AEC Program No. 5311)

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Equipment Development Group. Work in progress is listed below:

1. Preparations are being made for highly active Canadian pile-bombarded samples; when received, they will be processed in the 2-inch lead caves and auxiliary equipment and in the 6-inch lead walled straight-type cave. The latter is being modified so that it will contain a lead window in the wall of the cave for improved viewing and ball-socket manipulators, the ball part of which is to be made of uranium of about 5 inches in diameter.

2. Improvements are being made in target holders for the 60-inch cyclotron.

3. Work is drawing to completion on an all-metal box for chemical processing in an inert atmosphere.

4. Equipment used in processing a Canadian pile-bombarded sample received early in December has been disassembled, decontaminated and made ready for its next use.

5. In the Berkeley Box department, six boxes were assembled for special runs; one of the boxes used in connection with the mass spectograph was modified and repaired.

12. Plant and Equipment

RESTRICTED

M.T.A. - Mark I. (Program No. 9200. 5-424-9004) Development and design continuing.

M.T.A. - A-12. (Program No. 9200. 5-424-1004) Development and design continuing.

Bevatron Instrument. (Program No. 9500. 5-424-9001) Winding of the fourth quadrant of the magnet has been stopped due to the lack of spacers.

North Gate House. (Program No. 9500. 5-424-1001) The final inspection was held on December 18, 1951. The building was accepted and has been in use since December 20, 1951.

Animal House. (Program No. 9600. 6-424-9007) The animal food storage bins and cabinets for the west corridor have been installed and painted. Paving adjacent to the animal house has been delayed due to continuous rains. In spite of poor

access, some equipment and animals have been moved into the building and occupancy of the entire structure will proceed as soon as the paving is installed.

Radiological Laboratory at the U. C. Medical Center. (Program No. 9600. 6-424-9008)
The installation of the 70 Mev synchrotron has been completed including touchup painting. Tests of the instrument have been satisfactory. The asphalt tile flooring was laid in the accelerator room as the last step in preparing for an open house which was held January 11, 1952.

MAN-MONTHS EFFORT REPORT

Scientific Personnel

| PROGRAM | SUBDIVISION | MAN-MONTHS EFFORT | COMMENTS |
|-------------------------------|--|----------------------|----------|
| 9200 M.T.A. - Mark I | Design and Development | 8.27 | |
| 9200 M.T.A. - A-12 | Design and Development | 62.80 | |
| 9500 Bevatron | Miscellaneous | .15 | |
| <u>Operations</u> | | | |
| 3000 Weapons Research | General | 10.64 | |
| 5211 Physics Research | | | |
| Experimental Physics | Cloud Chamber | 11.29 | |
| | General Physics Research | 37.00 | |
| | Instrument for General Use | 3.98 | |
| | Special Development (Transferred to Weapons) | - | |
| | Magnetic Measuring Equipment | 1.84 | |
| | Charge-Exchange Accelerator | .65 | |
| Theoretical Physics | General | 10.43 | |
| Photographic Film Detectors | General | 11.25 | |
| Isotope Separation | General | - | |
| Radioactivity Physics | General | 2.00 | |
| 5261 Applied Physics Research | | | |
| Thomas Cyclotron | Electron and X-C Models | 19.54 | |

| PROGRAM | SUBDIVISION | MAN-MONTHS EFFORTS | COMMENTS |
|--|--|-----------------------|----------|
| Operations (continued) | | | |
| <u>Chemistry Research</u> | | | |
| 5311 Basic Chemistry Research, Part A | Chemistry of Heavy Elements | 2.80 | |
| | Nuclear Properties of Heavy Element Isotopes | 8.49 | |
| | Transmutations with 184-inch and 60-inch Cyclotrons | 5.90 | |
| | Analytical and Services | 17.21 | |
| | Special Chemistry Development | 1.00 | |
| | Mass Spectroscopy, Beta Ray Spectroscopy | 1.00 | |
| | Instrument Development and Services | 4.79 | |
| | X-Ray Crystallographic Measurements | 2.69 | |
| | Health Chemistry Research | 9.63 | |
| Basic Chemistry Research, Part B | Metals and High Temperature Thermodynamics | 4.0 | |
| | Basic Chemistry, including Metal Chelates | 3.5 | |
| 5361 Applied Chemistry Research | Process Chemistry | 6.91 | |
| <u>Reactor and Accelerator Operation</u> | | | |
| 5731 Synchrotron | Operation | 8.64 | |
| 5741 184-inch Cyclotron | Operation | 9.49 | |
| 5751 Linear Accelerator and Van de Graaff Generator | Operation | 5.00 | |

| PROGRAM | SUBDIVISION | MAN-MONTHS EFFORT | COMMENTS |
|-------------------------------------|---|--|----------------|
| 6000 Biology and Medicine Part A | Metabolic Properties of Various Materials | 11.0 | |
| | Radiochemistry and Radiation Chemistry | 5.0 | |
| | Radioautography | 2.0 | |
| 6000 Biology and Medicine Part B | Instrumentation for Quantitative Measurements of Radiation | 1.23 | .90 Consultant |
| | C ¹⁴ Metabolism | 2.81 | .68 Man-Months |
| | Use of Radioactive Materials in Human Physiology and Experimental Medicine | 9.70 | 5.18 |
| | Trace Elements and Irradiation Studies | 2.82 | 2.39 |
| | Radiation and Mutation Rate | 1.60 | .25 |
| | Physical Biochemistry | 10.91 | 3.54 |
| | Biochemical Response to Irradiation | 2.90 | .43 |
| | Machine Shop Expense | 1.00 | - |
| | Miscellaneous | .50 | .80 |
| | Donner Animal Colony Expense | 2.46 | 1.86 |
| | Metabolism of Lipo Protein and Lipids | 5.38 | 9.98 |
| | Iron Metabolism Hematopoiesis | 2.84 | .50 |
| | Internal Irradiation and Hematological Response. | 2.36 | - |
| | Biological Effects of Cosmic Radiation | 2.47 | .25 |
| | Health Medicine | 3.38 | - |
| | 6400 Biological Research | Synthetic and Experimental Organic Chemistry | 4.55 |
| Biological Chemistry | | 6.0 | |
| Photosynthesis Chemistry | | 4.78 | |
| Metabolism of Fission Products | | 10.71 | |
| 6500 Biophysics Research | General | 1.65 | |

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