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April 13-23 - 1938.

E. O. LAWRENCE,
JOHN LAWRENCE, and Group Working on the Cyclotron

FBH sees the old cyclotron, which is not running today as they are making adjustments and have it pretty well torn apart, making an unusual opportunity to see the insides of the instrument. Then, with Lawrence, across the road to the new Radiation Laboratory to see the medical and biological cyclotron. The end of the building containing this cyclotron is one large room, two stories in height; the remainder of the building is one story. The 190-ton magnet is set up and the floor just ready for laying. There is a great deal of space above and around the cyclotron, and it is hoped, after the entire equipment is assembled, that there will be space for a room to be cut off on one side and a second story added by putting in a floor above the cyclotron. The patients' treatment room will be built on one side of the cyclotron in such a way that the patient will not see the machine, which will be noiseless. L. has considerable expectation that an instrument of this extremely high voltage may reveal still other and at present unknown kinds of radiation. If this proves to be true they may require still greater space for protection; and the space will be available.

Various laboratories and quarters for Dr. John Lawrence in the new building are complete and in use. John Lawrence, an MD who had been teaching at Yale Medical School, came here last fall as Assistant Professor in the Department of Medicine. He spends three days a week in the Radiation Laboratory and three days a week in the U. of California Hospital in San Francisco. He brought his rat colony, containing four or five different tumor strains, from Yale, and will study effects of all kinds of radiations on neoplasms. At present he is continuing his work on the effects of radioactive phosphorus on leukemia. Preliminary experiments with leukemic rats produce startling results, and recently the treatment has been applied to human cases. The first two cases of leukemia were in a dying condition when treatment with radioactive phosphorus was started, and both patients died within the time limits previously set for their death. Today, however, they are discharging from the hospital an Italian who came in in fairly good condition but suffering with the 100% fatal disease of leukemia. His white blood count, upon admission, was 600,000! After the patient repeatedly drank a solution of artificially induced radioactive phosphorus, the count dropped to 5,000(within normal limits), and there are no other symptoms of leukemia. The white blood count, in leukemia, can be reduced by X-ray treatment, but a point is always reached where the red blood cells are

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also affected, and anemia develops. The promising aspect of the treatment with radioactive phosphorus is that while the white blood count is reduced to normal, the red cells actually slightly increase during treatment, thus eliminating the complicating anemia encountered with X-ray treatment. Smears of this man's blood have been sent to various histologists and they all report a normal blood picture. Weekly blood counts will be made of this individual for a long period to determine what happens following such a spectacular recovery. This is not being published, and they prefer that it not be known until it has been determined whether this is a cure or a temporary, though complete, arrest. A 12-year old boy suffering with leukemia was admitted to the hospital today, and they will begin running the cyclotron at night to prepare radioactive phosphorus for his treatment.

Dinner with Dr. and Mrs. E. O. Lawrence and a group including Professor and Mrs. Marc de Hemptinne, Institute of Physics, University of Louvain, Belgium.

L. requests FBH to return the next morning to see the cyclotron running, which FBH does. There are several other visitors present also. L. is apparently overwhelmed with people coming through to see the cyclotron. We are given a demonstration whereby a beam of neutrons is shot out into the air, violet colored. A piece of calcite, introduced into the beam, fluoresces. FBH meets some of L's group of young people and also the Assistant Director of the Radiation Laboratory, Dr. Donald Cooksey. L. tells FBH that C. is a member of the Physics Department at Yale, a wealthy bachelor who got interested in L's work and came out to assist for a brief period on a leave of absence from Yale. He has now been here three years and has become invaluable to the laboratory. He must decide at the end of this year to return to Yale or stay with L. There seems no doubt but that he will sever his connection at Yale. L. says that while C. was at Yale he was lazy and did very little research, but out here he works day and night in the laboratory, is especially interested in design, has charge of making all the blueprints for the new radiation laboratory and cyclotron, and does all the contact work with architects and contractors; in addition to which he acts as Godfather to all the young people in L's laboratory.

Dr. Loeb comes in at this point, and a brief chat with him about his father, Jacques Loeb, and his uncle, Leo Loeb, both old friends of FBH. Loeb professes a real interest in biophysics, although he, himself, will not actually engage in such work. Loeb spends his summer at the Scripps Oceanographic laboratory and knows the staff there well. He characterizes the new Director at Scripps, Svědrup, as a very able man who has, in the three years

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JOHN LAWRENCE, and Group Working on the Cyclotron (cont'd.)

he has been there, correlated the work, and is planning, with the new oceanographic boat given by the Scripps family, systematic surveys and study of the eastern part of the Pacific Ocean. Loeb knows Denis Fox at the Scripps laboratory, who is an applicant for a fellowship, whom he characterizes as a good sound worker but not brilliant. Loeb does not think very much of McEwen. (Copy to EB)

To go back to E. O. Lawrence, L. says that they had discovered artifical radioactivity before Joliot and Curie did, but wishing to be overly sure of their results, did not publish and were taking time to repeat the work. However, when the Joliots announced their discovery, for which the Nobel Prize was awarded, Lawrence confirmed their results within five minutes after he read their paper. FBH asks L. how the idea of the cyclotron came to him. The story is interesting. He was in the University library one evening, reading physics papers more or less at random when he came across one which described how voltage could be increased by arranging several electrodes in series. With a scrap of paper at hand, he got to figuring, rather idly at first, how this could be done and at the same time bend the particle in a magnetic field. And suddenly the entire principle of the cyclotron came to him and he had it completely worked out on a piece of scratch paper by the time the reading room was closed and he was asked to leave. There are some 25 or more cyclotrons throughout the world built or building at the present time. The Japanese have two cyclotrons running, each as powerful as L's present one, and the Japanese are building an exact duplicate of L's new and higher powered medical cyclotron. L. is cooperating with them on their new cyclotron by placing all of his orders in duplicate, i.e., there are a 190 tons of steel in his new magnet, but he ordered 380 tons, half of it to come to him and half of it for Japan, and so with all other orders for materials for the cyclotron. L's designs and blueprints are all made in duplicate, one set going to the Japanese.

Next year L. will have a large group of people working in the Radiation Laboratory, including 2 CRB Fellows, 1 or 2 NRC Fellows, 2 Commonwealth Fellows, 1 Guggenheim, and others, making up an international group of some 30 people. The Radiation Laboratory is now recognized as an independent administrative unit of the University. L. was told to write his own ticket as to the amount of teaching he wished to do. He has elected to give the Freshman lectures on electricity. The new cyclotron for biology and medicine will be running in about 9 months.