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SUMMARY OF THE RESEARCH PROGRESS MEETING OF FEBRUARY 28, 1952

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April 30, 1952

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Radiation Laboratory, Department of Physics
University of California, Berkeley, California

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I. Los Alamos Van de Graaff Machine. J. L. McKibben.

While visiting the University of California Radiation Laboratory Dr. McKibben consented to give a talk on some of the operational aspects of the Los Alamos Van de Graaff machine.

During World War II the Van de Graaf accelerator from the University of Wisconsin had been moved to Los Alamos. It was limited to 4 Mev (2 Mev neutrons). When in 1946 this machine was sent back to Wisconsin, it was considered desirable to design a new machine to replace it for use in thermonuclear research.

The Los Alamos Van de Graaff accelerator is designed primarily for use as a source of neutrons. A very practical feature is that the energy can be varied from about 4 kev to several million volts, which is useful for the study of thermal neutron reactions. Since the d - T reaction gives 14 Mev neutrons and p - T gives 11 Mev neutrons it was planned that the capacity of the new Van de Graaff would be in the range of 14 Mev down. No Van de Graaff of this size had been built for protons. Because previous machines had been seriously hampered by difficulties in making repairs and service changes, the idea was conceived to put a gas tight cylinder around the charging belt. The machine can now be taken down and put together again in an hour's time.

The Van de Graaff machine is built in a vertical position and is housed in a building 100 ft. high, the tallest in New Mexico. There is no

shielding except in the space between the operators and the accelerator. The tank is 13 1/2 ft. in diameter and the insulating column is designed to be 20 ft. high eventually. At present it is being operated only at 12 ft. Since the insulating column and accelerator tube are made in 2 ft. sections which are cemented together one on top of the other, additional 2 ft. sections (10 in all) can be installed or removed whenever the need arises. The outer gas in the tank is SF_6, which has a high dielectric strength.

A deflecting magnet at the foot of the accelerating tube is built on a rotating base and deflects the beam through 90° so that it may be used on the main floor at about 20 feet above the level of the ground. A movable service platform which may be lifted out facilitates servicing of the machine.

An rf type electrodeless discharge ion source is used. It has an advantage over the PIG type of source in that it gives an almost pure proton beam without contamination of di- or tri-atomic particles. For regulation of the beam energy a feature of the system employs a $\pm$ 25 kev control liner, which is used to control the spray on the downward run of the charging belt.

The main problem has always been recognized as that of the accelerating tube. Early in the building process a test generator had been built that would hold a 2 ft. tube section. The insulator chosen was mykroy, which cannot be punctured and permits a flashover several times. For the electrode rings Al tended to give the best voltages, holding 150 kev across a 3/8 in. gap. Experiments were made for size of tube with 6 in. and 8 in. inner diameter tubes. In the test generator without sparking the 8 in. tube would hold 1.7 Mev for 1/2 hour (for one section)

and the 6 in. tube 2.2 Mev. For two sections the 8 in. tube held ca. 2 1/2 Mev; for four sections ca. 3 1/2 to 4 Mev and for six sections up to 5 Mev. The 8 in. tubes have been used in preference to the 6 in. due to other problems such as pumping.

The machine, however, doesn't work too well above 4 Mev. Oil vapors and leaks may be a source of the trouble. A definite problem exists in obtaining a good sealing material for the cement used between the tube sections. Organic adhesives are not satisfactory and soft metallic solders tend to have cracks in the surface which lower the voltage. Silver has an objectionable feature of forming beads beyond the edge with a significant loss and mercury soldering presents problems too.

The Van de Graaff accelerator has been used since November for experimental work mostly on the scattering cross sections of neutrons.

II. Control of Red Cell Production in the Animal Body. D. C. Van Dyke.

The mechanism of constant red cell production in the body is not known. However, lack of oxygen and bleeding are two factors which increase red cell production, while hypertransfusion will depress the production. At present a method of control of red cell production is being studied by making use of the discovery of a possible new hormone.

In 1911 some of the earliest work tried to show that there is a circulating material which controls red cell production. This had been done by transplanting to normal subjects the plasma from animals which had previously been subjected to bleeding and then noting the increase in the number of red cells produced. Later work seemed to dispute this, but recent results are more conclusive. Experiments with artificial siamese twins show that the agent for stimulating red cell production is carried in the circulatory system. After artificial stimulation of

one of the twins the other also is stimulated; this fact indicates that the control agency (a humoral agent or hormone) must be a circulatory one since the only connection between the twins is vascular.

Since it was suspected that the pituitary gland may be involved and since the normal response to high altitude is an increase in red cell production, experiments in the high altitude chamber were conducted on normal rats and on those subjected to hypophysectomy (removal of pituitary). Results showed that hypohphysectomy did interfere with the normal rate of increase of red cells at 15,000 feet and produced anemia. The next step was to determine which of the known six pituitary hormones, if any, was responsible and which of the various target organs of the pituitary specifically controlled the bone marrow. The hormone ACTH was checked first and was found to produce polycythemia and to increase red cell production. On the other hand, the results were negative from tests involving adrenalectomy, thyroidectomy and castration.

Although ACTH gave the correct response, it was concluded that it was not the answer since adrenalectomy did not affect the normal response to altitude, nor, was the adrenal enlarged when the animal was kept at high altitude. Also, ACTH has a short biotic life and will be excreted before it can be exchanged between parabiotic partners. This fact ruled heavily against ACTH, since the experiment with siamese twins did show a stimulator to be exchanged and which must have possessed a longer biotic life.

The final conclusion reached is that the ACTH used in these experiments must be contaminated with a specific pituitary hormone which has nothing to do with the adrenal but does affect the bone marrow. At the present time this hormone is in the process of being isolated by purification and separation of the commercial ACTH preparations.

Information Division
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