MEDICINE

New Weapon Against Cancer Possible in Neutron Ray

Streams of Atomic Particles Unknown Before 1932 Found More Effective Than X-Rays for Animal Tumors

BECAUSE latest animal tests indicate that neutron rays (powerful streams of atomic particles totally unknown before 1932) are more effective than X-rays in killing animal tumors, it is possible that medicine is on the verge of applying a new weapon to human cancer.

Dr. John H. Lawrence of Yale University and Prof. Ernest O. Lawrence of the University of California reported to the American Society for Clinical Investigation, meeting in Atlantic City, the scientific data that raise the hopes of medical science for a more powerful weapon in its fight against cancer.

The Drs. Lawrence are brothers. Both are young men, in their thirties. Ernest is a physicist and he invented the giant cyclotron for producing high voltage atomic radiations with which he has obtained striking transmutations of the elements. John is a physician on the staff of the New Haven Hospital and he has pioneered in testing medically the new radiations produced.

Dr. John Lawrence explained to the medical scientists that new tests just completed in the University of California's radiation laboratory have indicated that, per unit of ionization, neutron rays are more effective than X-rays in killing one type of tumor in mice. The results will have to be confirmed by other experiments before definite conclusions can be drawn concerning the application of neutron radiation to human beings.

The Lawrence brothers are anxious not to arouse unjustified hopes among cancer sufferers. They emphasized that the application of neutron rays to human cancer is distinctly in the future. Even if all goes well in the experiments to be made it will be months and perhaps years before it will be possible to treat patients. They would not be talking now about their progress if they did not consider it important to inform fellow scientists.

Yet there is no question but that the outlook is enticing. Here is the way the scientists reason:

It is believed that the X-ray is relatively more lethal for cancer cells than for normal cells of the human body. Often it is impossible to give a large enough dose of X-rays to kill the malignant growth without doing damage to the patient. With this differential effect of X-rays, about 15 per cent of the cancer patients treated are cured or benefited. Suppose a radiation even relatively more lethal for cancerous than for healthy cells were obtained. The story would be different. A larger percentage of cancer patients treated could be saved. Neutron rays open up this possibility.

The tests reported by Drs. Lawrence were performed on a series of 600 mice of a strain which is peculiarly susceptible to a type of tumor known as Sarcoma 180.

The preliminary experiments indicate that the neutron ray is four times as lethal as the X-ray on this mouse tumor, but apparently only three times as lethal on healthy mice. This latter figure is less definite. Seven hundred to 750 roentgen units of neutron discharge will reduce the virility of Sarcoma 180 to a point where it will not grow when implanted in mice. On the other hand 3000 roentgen units of X-ray are required to accomplish the same result. This tumor resembles cancer in mice. Further experiments with true cancer in mice are in progress. There is a distinct possibility that neutrons will prove to be relatively more effective on tumor tissue than X-rays.

The idea that neutron rays might show a wide differential in their effect on different tissues was suggested by preliminary tests in the summer of 1935. The Lawrence brothers found that in changing the blood picture of rats the neutron ray was about five times as powerful as the X-ray. At the same time Paul C. Aebersold, who also was associated with the Drs. Lawrence in the present researches, and Dr. R. E. Zirkle of the University of Pennsylvania, demonstrated that in its effect on the tissues of wheat seedlings, the neutron ray was about ten times as powerful as the X-ray. From this it was sug-

GEOLOGY IN CARDBOARD

Thin slices of the western Wisconsin landscape, each represented by a cardboard profile with the vertical elevations much exaggerated, formed a striking exhibit at the spring meeting of the National Academy of Sciences in Washington, D. C. The tremendous job of cutting and measuring, and the exacting topographic research behind it, were the work of Drs. Douglas Johnson (at right) and Robert E. Bates, of Columbia University. The area represented is the region where western Wisconsin, southeastern Minnesota, and northeastern Iowa touch corners. This region was not plowed over by the great glaciers of the Pleistocene, so that the landscape is now very deeply eroded.

gested that there might be a similar difference in effect on various types of tissue such as animal tumors.

The neutron is a newcomer among the minute particles that compose matter. It was discovered in 1932 by Dr. J. Chadwick of Cavendish Laboratory, Cambridge, England, and the discovery was recognized by the award of the Nobel prize to Dr. Chadwick. It is considered to be one of the fundamental building blocks of atoms and it is notable because of its electrical neutrality, a quality that may have something to do with its seeming ability to penetrate more effectively into the center of atoms and living cells. In size it is far, far beyond the limit of visibility, as are all atoms. Its mass is approximately that of the lightest of atoms, hydrogen. Some scientists have suggested that it consists of an electron and a proton, the more familiar electrically charged particles, clinging together.

The neutron ray is therefore a stream of particles. The X-ray, on the other hand, is a radiation like radio waves and light, only with a frequency much higher, or to say the same thing, a wavelength much, much shorter.

Science News Letter, May 9, 1936

PHYSICS

Scientists Describe Design of Fortress for Atom Study

Half-buried Chamber, 60 Feet in Diameter, and Research Rooms Are Only Part of Elaborate Plans

See Front Cover

A VERITABLE fortress of science, that will have more than a passing resemblance to the famed "ring of steel" forts which France has built along its eastern border, is planned for early construction by the scientists of the Carnegie Institution of Washington.

A giant atom-smashing machine of the electrostatic type which will produce bombarding "bullets" of at least 10,000,000 volts energy will be built by Dr. M. A. Tuve of the Carnegie's Department of Terrestrial Magnetism, it was announced at the meeting of the American Physical Society in Washington. The construction of the new atom "fort" is comparable, in its field of atomic study, with the construction, 25 years ago, of the great 100-inch telescope which brought world-wide fame to Mt. Wilson Observatory of the Carnegie Institution.

A striking feature of the new design, said the report of Dr. Tuve and his colleagues, Drs. L. R. Hafstad and Odd Dahl, will be the use of earth, concrete and underground water-tanks to shield the delicate measuring equipment and the observing scientists from the potent, dangerous high-energy rays that the apparatus will produce.

A great high-pressure sphere, 60 feet in diameter, will be half-buried in the side of a hill with the high-voltage vacuum tube device inside. The underground target can be flooded with water for some experiments with piercing neutron beams. Scientists and their sensitive equipment will be located in yet another subterranean vault where they will watch what happens as the high-energy projectiles from the "fortress" strike atoms.

For the past few years the Carnegie scientists have been testing and experimenting with the predecessor of the proposed "fortress." With their machine, creating particles of energy 1,200,000 electron volts, they have demonstrated the feasibility of the new device which will yield particles with a minimum energy of 10,000,000 volts and perhaps even 15,000,000 volts.

The "bullets" from the atom fortress will be used to break through the "armor plate" of electric force which effectively—up to the last few years—has locked the secrets of atomic constitution within the nuclei of atoms. Only high-energy particles, the atomic "bullets," can pierce through the protective electric force and get inside the atomic cores.

The Carnegie Institution apparatus is a variation of the original atomic electrostatic generator devised by youthful Prof. Robert Van de Graaff of Massachusetts Institute of Technology. Prof. Van de Graaff at the same meeting announced that his device at Round Hill, Mass., can now generate potentials of 5,100,000 volts.

Prof. E. O. Lawrence earlier told the National Academy of Sciences that his atom-smashing apparatus—of quite a different type of construction since it whirls the particles round and round and gradually accelerates them—has just produced a particle beam with 11,000,000 volts energy. (*See SNL*, May 2.)

Thus on many fronts the battle of physicists, to wrest the secrets bound up in the cores of atoms, progresses.

The Carnegie Institution's proposed "fortress" is the latest of several types of equipment which are all directed to the same goal.

Science News Letter, May 9, 1936

GENERAL SCIENCE

No Danger of Suppression of Science in America

NO PRESENT danger exists that scientific discovery and thought will be underestimated or suppressed here in America, in the opinion of Dr. Frank R. Lillie, president of the National Academy of Sciences, expressed in his annual message to that "senate" of American science.

"This condition should heighten our sense of responsibility to see that its power and authority are not exaggerated," he told the academicians.

The Academy remains "firmly founded on the bedrock of scientific research, and serene in confidence in orderly thought, whether for the understanding or control of the processes in nature and in man."

As to the future, Dr. Lillie declared that the true friends of science recognize that limitations are set in nature and in the mind itself to scientific progress. Its rate, direction or extent for any considerable period of time can not be predicted.

"Yet I think," said Dr. Lillie, "that experience should give us confidence to claim that the conquering spirit of science is one of the strongest components of ideal social processes; and always will be."

Dr. F. F. Russell, former director of