PHYSICS

Man's Rays Stronger Than From Radium Win $1,000 Prize

Carnegie Scientists Now at Work on New Method Which Promises to Build Up Potential of 30 Million Volts

THE most intense radiations ever produced by man, stronger than the penetrating rays from radium now used in treating cancer, are being manufactured in the laboratories of the Department of Terrestrial Magnetism of the Carnegie Institution of Washington. Dr. M. A. Tuve, directing this research, reported its details to scientists of the American Association for the Advancement of Science in Cleveland.

The $1,000 prize of the A. A. A. S. for "a notable paper at the annual meeting" was awarded the paper read before the American Physical Society by Dr. Tuve. The report was the joint work of Dr. Tuve and his associates, Dr. L. R. Hafstad and Odd Dahl.

The war against cancer, now being waged with the use of less powerful X-rays and radium radiations, may be aided greatly if the novel methods of Dr. Tuve and his associates are made available for hospitals.

The treatment of cancer was not the objective of these investigations. Dr. Tuve's researches have been aimed at investigating the atom, and he has strived to produce the swiftest and most powerful projectiles with which to bombard the hearts of atoms.

Four Laboratories in Race

Four great laboratories of physics, located in Schenectady, Pasadena, Berlin and Washington, have been in a friendly race to create new vacuum tubes which will withstand the millions of volts necessary to produce the extremely speedy electrons which excel the radioactivity of radium.

The champions of man-made speed, beta radiations produced artificially in Dr. Tuve's apparatus, hurtle along at a velocity within one per cent. of that of light, which no material object, according to the laws of Einstein, can ever exceed anywhere in the wide flung universe. The electrons of these beta radiations speed along at more than 184,000 miles a second.

The three kinds of rays to which are due the extraordinary properties of radium have been produced artificially in Dr. Tuve's laboratory. In addition to the fast-moving electrons which are known as beta rays, there are gamma rays, an electromagnetic radiation like light, but much shorter in wavelength. These artificial gamma rays are produced when the beta rays jolt a metal target placed in their path, although the gamma rays from radium are the result of disturbances in the core of the disintegrating atoms. The third kind of artificial radium ray is called alpha radiation and consists of heavy material hearts of helium atoms with two electrons bound to them.

Artificial alpha rays should be useful projectiles to shoot into matter in the hope of tearing an occasional atom into pieces. But Dr. Tuve plans to use the hearts of hydrogen atoms instead of helium atoms when he attacks the problem of atomic structure.

When the high voltage tubes are operating, the dangerous gamma rays penetrate to every corner of the laboratory. They can pass through three inches of lead and the danger from them is so great that physiologists have been summoned from Johns Hopkins University to study how the experimenters may be protected.

The tubes, which are constructed by a special glass blowing process that prevents the electrical discharge from puncturing the glass, have been operated reliably at two million volts.

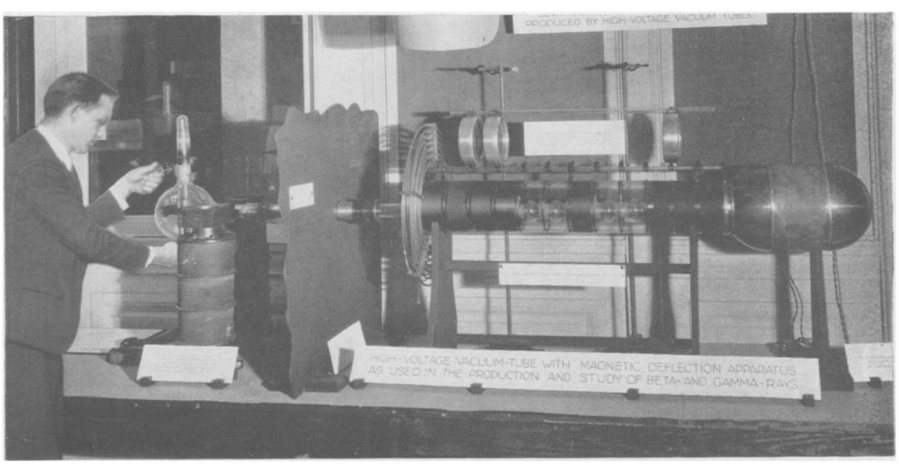
Although Dr. Tuve in delivering the prize paper at Cleveland did not discuss it, he and his associates are now at work on a new method of building up electrical voltages that should soon make it possible to impress upon gigantic X-ray or other vacuum tubes voltages much higher than the five million or so they have generated so far. Thirty million volts are theoretically possible with a modification of what is called the Faraday cage which has been developed.

Greatest Exploration of Matters

By using these voltages to accelerate the positively charged cores of hydrogen atoms, these scientists will have by far the most powerful projectiles ever available to a human being. These will resemble the alpha rays from radium. What will happen when they are let loose is still a matter of discussion among scientists.

Some physicists have suggested in the past that if such powerful radiations were allowed to smash into the hearts of atoms, there might be a liberation of the immense internal energy of the atoms with a gigantic explosion that would wipe out the world and this corner of the universe. This idea was the theme of the Broadway success of several years ago "Wings Over Europe" in which a scientist, not unlike the Dr. Tuve of real life, solved this secret of physics and held the fate of the nations and the world in his grasp.

But most physicists do not expect such a cataclysm. They expect the artificial radiations to be extremely useful in probing deeper the fundamental structure of matter. They expect as a by-



SUBJECT OF THE PRIZE PAPER

High voltage vacuum tube with magnetic deflection apparatus used in the production and study of beta and gamma rays.

product that the powerful radiation will be useful in the treatment of cancer and possibly put to other medical uses. They expect that the radiations will give new knowledge of the earth's magnetism and how it is caused. This latter possibility was the starting point of the whole investigation and the reason for its support by the Department of Terrestrial Magnetism of the Carnegie Institution directed by John A. Fleming. Incidentally, there will also come a better understanding of radio because physicists feel sure that the radio reflecting Kennelly-Heaviside layer above the earth is affected by natural radiations that come from the sun and outer space.

Dr. John C. Merriam, president of the Carnegie Institution, expressed delight at the award of the American Association prize to the three members of his institution and explained: "Their work represents a long continued intensive study of this problem and it is a great pleasure to know of the recognition of the work at this stage of the investigations."

Science News Letter, January 10, 1931

BIOPHYSICS

"Artificial Cells" Point Way To Greater Knowledge

Famous Physiologist Thinks Creations of Cleveland Surgeon Will Aid Understanding of Living Matter

By DR. D. T. MacDOUGAL

Research Associate, Carnegie Institution of Washington

EDITOR'S NOTE: At the Cleveland meeting of the American Association for the Advancement of Science, Dr. George W. Crile, famous surgeon of Cleveland, announced the making of "autosynthetic cells" out of non-living extracts and mineral salts, and showed specimens under the microscope. This critique of Dr. Crile's work is written especially for the SCIENCE NEWS LETTER by one of the world's foremost students of plant physiology.

TO THE biologist concerned with the form and architecture of the living cell, the announcement of the results of Dr. Crile's researches on masses of stuff which show some of the properties of living matter will come as something of a shock.

The physiologists, however, especially the group who are engaged in studying the properties and the ultimate arrangement of particles in protoplasm, find in Dr. Crile's results many things of absorbing interest. Furthermore, there is a growing belief among workers that we may within the near future be able to set up small masses of material in the condition of a jelly in which many of the activities characteristic of living matter may take place.

Thus, for example, I have definite recollection that Jacques Loeb, whose researches are well known to all biologists, expressed high hopes that something like living matter would be compounded within the laboratory within a very few years.

Many of the experimental attempts in this direction have gone no further than the making of minute blobs of colloids which on the glass slide and under the microscope gave resemblances to the indefinite and constantly changing forms of the amoeba. The physiologist is primarily concerned with the energetics, performances or processes which go on unceasingly in living matter. In my own experiments in this direction, begun in 1922 at the Desert Laboratory of the Carnegie Institution, in Arizona, I went no further than taking capsules of cellulose, lining them with mixtures of jellies made up of the materials which enter into the composition of the plant cell.

Although the intimate arrangement of these materials could not be said to have been identical with that in living material, except in a general way, yet these experimental devices displayed two forms of activity quite similar to that of the absorbing hairs of roots. In an often-repeated series of experiments the permeability of these jelly layers was found to be similar to that of the tissues of living plants. The common mineral nutrient elements sodium, potassium, magnesium and calcium entered these "artificial cells" at the same relative rates as in a piece of living tissue.

The second performance in which the activity of living stuff was imitated was one in which these "artificial cells" maintained their acidity for days at a time when immersed in an alkaline solution, after the manner of the protoplasm of a plant growing in an alkaline soil.

What the Cells Do

Some of these experiments were shown to Dr. Crile at the Desert Laboratory. I have therefore viewed these exhibits of Dr. Crile's results at the Cleveland meeting of the American Association for the Advancement of Science with considerable interest.

Dr. Crile brings together proteins, lipoidal brain extracts and mineral salts in small cavities on glass slides. Masses of material resembling unicellular organisms of various types appear in a few seconds.

The chief interest, however, lies in the fact that when quantities of this material sufficient for chemical and physical tests are accumulated, with characteristic electric potentials, stainability and other physical properties are readily measurable, and respiration data similar to those of masses of living tissue are secured. The transformation of energy indicated is at a rate which changes and runs through a cycle after a manner shown only by living organisms.

Only the worker who has engaged in experiments of this kind is in position to appreciate the enormous amount of wearisome labor necessary to secure the most meager results. It may be regretfully said that the difficulties attending a repetition of Dr. Crile's experiments will delay a checking-up of his results by other workers, which is so highly desirable in all scientific research.

Neither Dr. Crile nor anyone else makes the claim that he has actually "created life" in the laboratory. But the way is indicated along which we must travel in the endeavor to gain a fuller understanding of the nature of living matter.

Science News Letter, January 10, 1931

CHEMISTRY

Substitute for Sulfur Vulcanizes Rubber

A FIRST cousin to the TNT of wartime, a chemical called trinitrobenzene, will make possible rubber that can be used next to shiny silver and other metals without fear of causing tarnishing, discoloring and corrosion of the metals.