

PHYSICS

New Kind of Atom Smashing Liberates Millions of Volts

Experimenters Bombard Lithium, a Metal, Which Combines With Hydrogen and by Disintegration Forms Helium

By DR. VICTOR COFMAN
Science Service Correspondent

A NEW TYPE of atomic disintegration that liberates millions of volts of internal atomic energy is disclosed by experiments by Drs. J. D. Cockroft and E. T. S. Walton working in the Cavendish Laboratory, Cambridge, England.

Details of the experiments are given in a letter to *Nature*. These are experiments that Lord Ernest Rutherford, director of the Cavendish Laboratory, has described as important additions to his own previous researches on the constitution of the atom and radioactivity.

Drs. Cockroft and Walton found that when lithium of atomic weight seven is bombarded with protons accelerated at 600 volts, a new kind of splitting of the atom occurs with the release of sixteen million volts of internal energy. The lithium atom apparently captures a proton and then breaks up into two alpha particles with energy of eight million volts each.

Not Practical

Since the proton, the positive particle of electricity and matter, is the nucleus or heart of the hydrogen atom, and the alpha particle is the nucleus or heart of the helium atom, it may be said that lithium, the lightest of metals, was bombarded and combined with hydrogen to form by disintegration the gas helium. More important than this transmutation is the fact that energy wrapped up in the lithium atom was let loose and given to the helium atom hearts or alpha particles that were produced. Quantitatively sixteen millions of volts were obtained whereas only six hundred volts were fed into the transformation. The reason the experiment does not provide a practical source of power is that this occurs only one time in several million attempts.

The experiments of Drs. J. D. Cockroft and E. T. S. Walton at Cambridge, England, are important because they demonstrate that atoms in being arti-

cially smashed can liberate more energy than is put into the smashing process.

Although atoms have been disintegrated before, the kind of splitting discovered by Drs. Cockroft and Walton is novel. Atoms are made up of various building units, principally protons, alpha particles, and loose electrons. The proton is the positive unit of electricity and matter and it is the heart or nucleus of the hydrogen atom. The alpha particle is the nucleus or heart of the helium atom and is made up of four protons and two electrons bound together. The electron is the negative unit of electricity or matter. Atoms are visualized as made up of hearts consisting of protons, alpha particles and electrons wrapped in a compact, heavy nuclear package, surrounded by outside electrons that can be easily removed.

The lithium atom attacked in the Cambridge experiments consists of one alpha particle and three protons with necessary negative electrons to balance the charge of the positive part. The bombardment under relatively low voltage added a proton to the combination, which then split into two alpha particles. The three protons originally in the lithium atom evidently combined with the proton to form another alpha particle.

Lord Ernest Rutherford in 1919 was the first to disintegrate artificially an element when he bombarded nitrogen gas with alpha particles, which are rushing hearts of helium atoms given off by

radioactive substances, and obtained hydrogen. It was familiarly said that Rutherford thus knocked H out of nitrogen. Even earlier in 1896 Becquerel in France observed the spontaneous disintegration of the element uranium and thus discovered radioactivity, inaugurating the fruitful search of science into the constitution of matter. Since then it has been discovered that many atoms, particularly the heavy ones, are radioactive and that any of the light ones can be disintegrated (*Please turn page*)

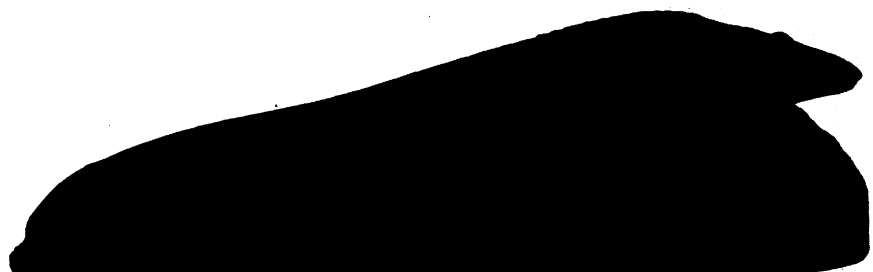
PALEONTOLOGY

Land Animals Small When Coal Was Forming

THERE were giants in the earth in the Coal Age, but they were all trees; weird growths like the modern horse-tail rushes, but fifty feet high and a foot thick; others just as strange, with sword-like leaves, that have left no living representatives. But all the land animals, in those days before the dinosaurs, were comparatively puny things; small creatures very much like modern salamanders, not over a foot or two long; though some, by virtue of interminable tapering tails, attained a length of nine feet. And there were a few eel-shaped ones, like the so-called "blind-worms" of the present day.

Their bones are not at all well preserved. Most of the little we know about them comes from impressions of their bodies in coal beds, and from more abundant tracks of their feet in muds that subsequently hardened into shales. But sufficient skeletal material has been gathered to enable the noted paleontologist, Dr. William K. Gregory, to direct the sculpturing of a restoration which can now be seen at the Field Museum of Natural History in Chicago.

Science News Letter, May 14, 1932



FROM THE PRIMAL SLIME

Field Museum Photo.

Diplovertebron is the formidable name given to this not-very-formidable salamander-like animal that crept through the primal slime of Coal Age swamps. Its descendants, relatively little modified, are found in wet places today.

by bombarding them with the radiations shot out from the heavier radioactive elements.

The experiment of Drs. Cockroft and Walton was not the first that obtained greater energy from an atomic transformation than was put into it.

Prof. W. Bothe, German physicist, reported a few months ago that he bombarded beryllium metal with alpha radiation or helium hearts from radioactive polonium and turned it into carbon, observing gamma rays that might be called artificial cosmic rays to be emitted with more energy than was put into the operation. This advance, reported exclusively by Science Service in a signed article by Prof. Bothe, was hailed as the first successful synthesis of matter and the first atomic transformation that yielded a gain in energy.

Upon the basis of such experiments, the hope of obtaining "something for

nothing," that is, getting more energy out of matter than is put into it, is due for a revival. Practical transmutation of one element into another has caught popular and scientific imaginations since the days when chemistry was alchemy. While there is little hope of turning lead into gold or synthesizing hydrogen into helium with a gain in energy that would do the work of the world, the new atomic researches promise to tell more about the way matter is put together. Eventually the syntheses and disintegrations may be put to work, but this will probably take years and decades. In the Bothe experiments only one in fifty thousand of the projectiles hurled hit its mark and the process as a whole is dreadfully inefficient although when hits are made energy is gained. In the Cockroft-Walton experiments for every atom disintegrated several millions of particles were required.

Science News Letter, May 14, 1932

not killed by it. Yeasts, which often damage food products by starting undesired fermentations, are also difficult to destroy.

Carbon dioxide is not the only gas that can be used, it is pointed out, but it is best in most cases because it is more soluble than other easily obtainable gases, such as hydrogen or nitrogen. For a given working pressure it will therefore have considerably greater effect.

Science News Letter, May 14, 1932

AVIATION

Navy Airplanes To Be Free of Carbon Monoxide

ALL NEW airplanes built in future for the U. S. Navy will be tested at the factory for the presence of carbon monoxide in the cockpits, and if this deadly gas is found, even in minute quantities, it must be eliminated before the planes will be accepted.

This new requirement is the result of an investigation into the hazard of the pilot from the exhaust fumes of his engine, conducted by Dr. Joel J. White, of the division of aviation medicine of the Navy.

Blood tests of pilots after flights revealed that the highest concentration of carbon monoxide in the blood, 15 per cent. of saturation, was not sufficient to cause unconsciousness, but was enough, if continued over a long period, to have a bad effect on the pilot's health and efficiency. Exposure to a low concentration over a long period is more harmful than a brief exposure to a very high concentration.

A comparatively simple and inexpensive modification of the exhaust leads serves to eliminate the gas from those parts of the plane where it might be breathed by the pilot or passengers.

An interesting feature brought out by the investigation, which is reported in full in a current issue of the *U. S. Naval Medical Bulletin*, is that exposure to the gas was greater in open cockpit planes than in the types with closed cabin.

For convenience in testing for the presence of carbon monoxide, the Bureau of Medicine and Surgery of the Navy in cooperation with C. E. Earle, Navy chemical engineer, and the Mine Safety Appliances Co., developed a new type of carbon monoxide indicator which makes use of a chemical "hopcalite."

Science News Letter, May 14, 1932

BACTERIOLOGY

Bacteria Exploded in Making Of New Type of Vaccines

BACTERIA, blown to bits by the sudden release of carbon dioxide that has been literally squeezed into them under a pressure of 800 pounds per square inch, are being used to make vaccines of a new type, without the use of heat, by David Crowther, a New York scientist. Advantages claimed for the new vaccines are that they are more effective and keep better than vaccines made with the use of the heat.

The physical principle involved is exactly the same as that which causes a bottle of pop to "fizz" when the cap is removed. The gas has been introduced under pressure and has gone into solution. When the pressure is released the gas comes out of solution and explodes in bubbles. The same sort of thing happens when grains are "puffed" to make breakfast foods; though here the exploding force is that of steam. Only the bacteria "pop" much more thoroughly than the grains do; they lose any semblance of bodily form and release their protoplasm into colloidal suspension, like white of egg stirred up in water. In this form, the substance of the bacteria has the power to provoke the tissues of organisms into which it is injected to form protective substances or antibodies, just as ordinary vaccines do.

While the process is still in the experimental stage, large quantities of vaccines have been made and the experiment continues.

The same process of "popping" living organisms with a gas that dissolves in their tissues under pressure has been used by Mr. Crowther for the destruction of insects and their eggs and larvae, especially species that infest stored products. Possibilities of its use on a commercial scale are seen, where heat or chemical extermination of such pests are not practicable. For example, it is pointed out, neither heat nor chemicals will readily penetrate a package of flour, a bale of cotton or a bag of seed, but such materials, subjected to the pressure of a gas, are readily and completely penetrated.

Spores Not Killed

When the gas pressure is released, temperature is reduced somewhat; but since most of the products that might be treated by this method are not harmed by moderate degrees of cold this does not constitute a serious objection.

The new method is not universal in its applicability, however. Bacterial spores, which are highly resistant resting stages of some species of bacteria, are