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MATTER CREATED FROM LIGHT AND COSMIC RAYS

TANGIBLE matter is being created out of light and cosmic rays which come to earth from outer space. Radiation produced here on earth is also manufacturing in some proved instances matter out of intangible waves.

Conversion of mass of the stars to produce light and heat has been the favorite method of explaining their long life. That has been the classic example of the interchange of matter and radiation.

Now evidence is accumulating for the reverse process, the creation of matter out of radiation, not in the far-distant stars, but here on earth.

The idea that matter is created by light or photons was put forth by Dr. P. M. S. Blackett and G. Occhialini, of the Cavendish Laboratory of the University of Cambridge. The light prefers to perform this miracle only in the neighborhood of an atomic nucleus. The matter is created in the form of a pair of electrons, one positive and one negative. The theory is formulated on the basis of Dr. Carl D. Anderson's discovery of the positive electron and the subsequent confirming researches at Cambridge.

Experimental evidence for the creation of matter is contained in the bursts of electrons due to cosmic rays observed by Dr. Anderson in his apparatus at the California Institute of Technology. And Dr. Anderson recently found pairs of electrons formed by the gamma rays given off by thorium. The positrons or positive electrons so formed do not live long, however, since they unite with negatives to form photons or light again.

The latest development is that Dr. J. R. Oppenheimer, of the California Institute of Technology, and Dr. Milton Plesset, a National Research fellow, have found that the theoretical equation of Dr. P. A. M. Dirac is quite in accord with the facts. This has led to important predictions bearing on cosmic rays.

Photons of high energy much prefer to produce the pair of electrons than to transfer their energy to a single ordinary electron. All of the photons or cosmic rays are equally effective in producing new pairs.

After discussing these new developments at Pasadena, Dr. Niels Bohr, the Danish physicist who is spending some weeks at the California Institute of Technology, commented that the calculations by Drs. Oppenheimer and Plesset have convinced him that the Dirac equation instead of being false is the greatest acquisition to human knowledge in the past few years.

MUSCULAR WEAKNESS IN GRAVES' DISEASE

THE extreme muscular weakness that marks Graves' disease has a chemical basis and is not just due to the nervousness which also features the ailment, Drs. E. Shorr, H. B. Richardson and H. G. Wolff, of the Cornell Medical School and New York Hospital, reported at the Washington meeting of the American Society for Clinical Investigation.

This is a disease involving the thyroid gland. Some patients suffering from it have marked goiters and bulging eyes, as well as the nervousness, muscular weakness and increased metabolism. The disease is also marked by the excretion from the body of large amounts of a chemical substance called creatine.

Creatine is present in the muscles as part of the compound phosphocreatine. When muscles contract, this compound breaks down into creatine and phosphoric acid. In the recovery of the muscle the two substances are recombined into phosphocreatine. If the latter substance is not adequately rebuilt in the muscles, they will fail to function properly. In Graves' disease, one of the parts, creatine, of the essential phosphocreatine is excreted from the body in abnormal amounts instead of being completely recombined with phosphoric acid.

This abnormal excretion of creatine also occurs in another condition known as progressive muscular dystrophy, characterized by marked muscular weakness associated with degenerative changes in the muscles.

These investigators found many points in common between the two conditions. Most of the chemical reactions formerly considered characteristic of the creatinuria of muscular dystrophy were consistently found by them in patients with Graves' disease. An additional point of resemblance between the two conditions is that actual muscle degeneration, especially of the eye muscles, has also been observed in Graves' disease.

These observations do not imply that these diseases have a common origin, but suggest that a similar damage to the important phosphocreatine mechanism is sustained in both, and is responsible for the muscular weakness.

For these reasons, the creatine excretion in thyroid disease is regarded as potentially dangerous to the functional and anatomical integrity of the muscles. It can be abolished by giving iodine, which has long been established as an important therapeutic agent in Graves' disease.

CHEMICAL WARFARE BY INSECTS

CHEMICAL warfare with special weapons is waged by certain species of insects in India, according to Dr. Thomas E. Snyder, of the Bureau of Entomology, U. S. Department of Agriculture. Dr. Snyder has recently completed a study of a large collection of these insects in the U. S. National Museum.

The insects are termites, often incorrectly called "white ants." Termites are not ants, and are related to them only insofar as both termites and ants are insects. Ants, indeed, are among their worst enemies, and it is against ants that the chemical weapons studied by Dr. Snyder are most effectively employed.

The termites bearing these weapons belong to a special "caste" within the termite nest; they are developed for defending the colony just as others of their nestmates are specialized into a worker "caste." In these particular species the soldier termites have as chief weapon a long protrusion from the front of the head. Originally

it developed from a third eye, but now its function is to secrete and discharge a powerful corrosive acid. Some of them can squirt it almost an inch, but such cases are exceptional.

When enemy ants invade the termite nests guarded by these chemically armed warriors, the latter rush to the combat. They know the weak spot in their opponents' armor, and go straight for it. Shoving their long snout-like weapons against the ant's "waist" or pedicle, they smear it with the corrosive secretion. The ant quickly becomes helpless.

Termites, whose depredations in wooden structures in New York have recently caused something of a stir, are primarily animals of the tropics, although a few destructive species have become widely distributed over the southern and eastern parts of our own country. They feed primarily on wood and other cellulose substances, and can cause immense damage if not guarded against. In the tropics they can hollow out a house and all the wooden furniture in it, besides eating up all books, stored clothing, and almost any other vegetable fiber they can fasten their jaws into.

THE CAUSE OF FATAL DISEASE IN YOUNG LAMBS

DURING the California lambing season, a disease hitherto of unknown origin has inflicted heavy losses upon newly-born lambs on farms that are widely separated.

Dr. Hilda Hempl Heller, while at Hooper Foundation for Medical Research of the University of California, fastened the apparent guilt of causing this disease upon one kind of the very common colon bacilli, the sort of germs widely found in the intestinal tract of animals.

An unusual circumstance of this disease is that, though it is an infection, the mechanism of its action resembles that of a food poisoning. The little lamb, just after being born, drinks its mother's milk, which is not poisonous. When in some way it is infected with the colon bacillus at a virulent stage, the germs form a poison in the milk within the lamb's alimentary tract. The lamb dies from absorbed poison rather than from the direct attack of the germs.

The germs charged by Dr. Heller with causing the disease are extremely variable and they have been found to change their deadliness rapidly.

Dr. Heller, who is an authority on botulinus poisoning, began work on the disease because it was thought that it was a disease caused by an anaerobe, or air-hating germ. She found that a powerful poison was present in the lamb intestines, of which five drops would kill a mouse in two and a half hours. The blame for forming this poison could not be fastened upon any anaerobic germ.

The poison-producing power of the colon bacilli found in the lambs was then demonstrated by Dr. Heller. When grown in test-tubes the isolated germs produced a poison identical in effect with that obtained from the lambs. Dr. Heller, who worked on this problem with the cooperation of the University of California's Division of Veterinary Science, located at Davis, California, did not have the opportunity to clinch the proof by infecting lambs, because when the presumably guilty organism was isolated and proved to be rapidly fatal for guinea-pigs, the lambing season was over.

Dr. Heller hopes to be able to continue research upon this lamb disease. It seems probable that it is widespread in the sheep-raising areas of this and other countries, and must cause a loss amounting to many thousands of dollars annually. It may also be related to a similar disease of calves which is responsible for even larger financial losses.

THE WHEAT CROP

WINTER wheat in the United States promises the shortest crop since 1904, the May issue of *Wheat Studies* of the Food Research Institute estimates. The official forecast as of May 1 indicated a crop of only 337 million bushels, 125 million below the standing estimate of last year's crop. Acreage abandonment was unprecedentedly high, over 32 per cent., leaving the smallest area for harvest since 1912.

Reports of farmers' intention to plant spring wheat indicated that the acreage sown this spring in North America may be four or five per cent. smaller than the area planted in 1932. Since the publication of the institute's report, unfavorable weather has held back spring wheat planting, along with practically all other crops, so that some shortage in spring wheat may be expected also, though whether it will be as great as that in winter wheat can not now be predicted.

One major wheat harvest of the world, that in India, has already been reaped. It is officially estimated at 340 million bushels, a trifle larger than the 1932 crop. It is not expected that the Indian crop will have much influence on world wheat prices during the May–July period.

European wheat-importing countries are still striving for as much self-sufficiency as possible in wheat. They are expected to harvest as large an area as last year's, if not a little larger, but the crop is expected to be smaller by 100 to 150 million bushels. This will be at least partly balanced, however, by a larger crop anticipated from the great wheat-exporting regions on the Danube, where last year's crop was a virtual failure in Rumania and Jugo-Slavia.

In Russia the area sown to winter wheat was more than four million acres smaller this year than last, and spring wheat plantings will probably be no larger. But even if the crop increases, as is fairly likely, much of the early surplus normally exported will have to go for the relief of the domestic food shortage.

Prices on wheat are expected to advance, but more from currency and general economic causes than because of crop conditions.

The current report of the Food Research Institute was written by M. K. Bennett and Helen C. Farnsworth, with the advice of Joseph S. Davis and Holbrook Working.

THE PURE FOOD AND DRUG BILL TO CONGRESS

AT the direction of President Roosevelt, Secretary of Agriculture Wallace has sent a bill for a new national pure food and drug law to Congress.

The new bill has been carefully planned to remedy the deficiencies of the present food and drug law, which

was enacted nearly 27 years ago after a strenuous campaign by the late Dr. Harvey W. Wiley.

The limitations of the present law make it impossible to carry out its intention of protecting the public from impure or harmful foods and drugs, Secretary Wallace pointed out in submitting the new bill.

Under the new bill, the secretary is authorized to set definitions and standards of purity for foods, just as there are now legal standards for official drugs. Under the present law such standards may be set for canned foods only.

False advertising is to be prevented under the new bill. At present there is no way, under the Food and Drugs Act, to control the serious abuses in this field.

The present law prohibits false or misleading statements on the labels of foods and drugs, but under the new bill, labels must tell enough about the product so that the consumer will know what he is getting and can buy intelligently and discriminatingly.

Cosmetics are to be brought under federal control so as to prevent the serious injuries that have occurred through the sale and use of harmful cosmetic products.

Another important feature of the bill is the provision directed at the sale of drugs labeled as treatments for various diseases. The Food and Drug Administration under the new bill will be able to prevent the sale of such drug products if the claims for them are contrary to general agreement of medical opinion. At present an influenza cure, for example, which physicians agree will not remedy influenza, can not be kept off the market unless the Food and Drug Administration can prove that the claims for the remedy are not only false but made with the intention of deceiving the public.

ITEMS

DIFFICULTY in measuring the energy of cosmic rays presents the greatest problem to the physicists studying them, Dr. R. A. Millikan stated in a discussion following a summary of recent experiments presented by his colleague, Dr. H. Victor Neher, at the California Institute of Technology. Dr. Paul S. Epstein presented a very successful theory which pictured the cosmic rays as a stream of photons accompanied by several weaker groups of electrons. But the experimenters were warned against accepting theories until energy measurements of the rays became more complete. Meanwhile, all investigations indicate that photons predominate in cosmic rays, but that some electrons also enter the earth's atmosphere. A strong support for the photon idea was presented by Dr. Carl D. Anderson, who announced that he had produced positive electrons or positrons with photons from thorium. If photons are known to produce positrons and if no other method is known then the positrons which are found with cosmic rays were probably produced by photons too.

INTRODUCING "deuton" as a new name for the double-weight hydrogen atom only known to science for a little over a year, Professor Ernest O. Lawrence, of the University of California, reported to physicists meeting at Pasadena what happens when the heavy isotope of hydrogen is used as a projectile in smashing various elements. Only about a month ago, Dr. Gilbert N. Lewis supplied Professor Lawrence and his associates, Drs. Henderson and M. Stanley Livingston, with some deutons. The atom-smashing was done with the aid of potential up to 1,500,000 volts imparted to the deutons with Professor Lawrence's magnetic method of creating high voltages. Lithium, beryllium, boron, nitrogen, fluorine, aluminum and sodium gave good results. Transmutations occurred, alpha rays were formed, and probably other processes yet to be examined followed.

SPECTRA lying between the x-rays and the ultra-violet rays of 1,200 Ångstrom units, in which absorption spectra have hitherto been unknown, have been found by Dr. H. Beutler, Berlin physicist. The elements giving the newly discovered spectra are rubidium, caesium, cadmium and mercury. Helium was exposed to a condensed discharge to produce light from 900 to 600 Ångstrom units. The light source and the test vapor could not be separated from the vacuum spectrograph used by a window or other device because no material known allows these rays to pass through. The new lines can not be observed in emission but only in absorption. They are interpreted as arising from a change in the quantum numbers of an inner electron while the valence electrons remain unexcited and they thus represent a transition from optical to Roentgen spectra.

DR. JAMES CHADWICK, of Cambridge, discoverer of the neutron, delivering the Bakerian lecture of the Royal Society, awarded a tentative decision against the neutron as the cause of formation of the positron, another newly discovered particle of matter, when radiations from radioactive beryllium pass through a lead plate. The radiation from beryllium consists of neutrons and gamma rays. The neutron can be thought of as a corpuscle, but gamma rays are like light, x-rays and radio waves in being electromagnetic waves. Positrons or free positive electrons are produced by atom smashing when the mixed beryllium radiation is allowed to attack lead. The neutrons were accused at first, but now Dr. Chadwick believes that the gamma rays, not the neutrons, may be responsible. Out of 300 electron tracks produced in his experiments, 200 were made by the familiar, long-known negative electrons, while 70 were positive. Dr. Chadwick's work at Cavendish Laboratory agrees generally with researches by Dr. Carl D. Anderson, of California Institute of Technology, who last fall discovered the positron.

BEAUTIFUL phosphorescent light given off by certain sponges living in shallow waters is really due to small worms that inhabit them, according to Professor Emanuel Trojan, of Prague. The little light-producing worm is scarcely a quarter of an inch long, but can send branches an inch and a half in all directions. Professor Trojan tells *Nature* how he coaxed the little animal out of its hiding place by attaching the sponge to the edge of an inclined bowl, allowing the water to drip slowly out of the sponge into the bowl. As the sponge became too dry for comfort, the water-loving worms came out of their hiding-place.