SCIENCE NEWS

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HEAVY HYDROGEN

DIRECT proof of the synthesis of matter has been brought to light by the discovery of a new heavy, heavy hydrogen atom of mass three. The discovery resulted from experiments conducted by Professors Gaylord P. Harnwell, Henry D. Smyth and Walker Bleakney, all of the department of physics of Princeton University.

Through these experiments there have been found minute traces of this very heavy variety of hydrogen of mass three in a sample of almost pure hydrogen of mass two supplied by Professor Hugh Taylor, of the department of chemistry. This was accomplished by using a mass-spectrograph of very high sensitivity recently constructed in the Palmer Physical Laboratory at Princeton. This apparatus is capable of detecting one part of hydrogen of mass three in a million of mass two and in the sample analyzed actually recorded one part in two hundred thousand.

This experiment has served to prove the existence of this third isotope of hydrogen in a stable form in nature and has given an estimate of its abundance. Apparently it is present to less than one part in a billion of ordinary hydrogen.

Lord Rutherford and his associates at the Cavendish Laboratory in Cambridge, England, have obtained evidence that when two atoms of heavy hydrogen, which have a mass of twice that of ordinary hydrogen, strike one another with sufficient energy a process of atomic transmutation takes place. These two atoms of mass two probably coalesce into an unstable atom which flies apart, not as the two atoms of mass two, from which it was formed, but as one atom of mass one, which is ordinary hydrogen, and one of mass three, which is a variety of hydrogen heavier than any previously known. The evidence for the existence of this third very heavy hydrogen has been of extremely indirect nature until the completion of these experiments at Princeton. An experiment of the same nature as that of Lord Rutherford's has been performed by Professors Harnwell and Smyth. Some hydrogen of mass two was bombarded for a considerable time by more of the same hydrogen and later the resultant mixture drawn off and analyzed in the mass-spectrograph by Dr. Bleakney. It was found that after this process the ratio of hydrogen three to that of hydrogen two had increased from the original ratio of one part in two hundred thousand to about one part in five thousand. The only adequate explanation appears to be that the transmutation process postulated by Lord Rutherford actually occurs.

This recent experiment is the first instance where any atomic species has been produced artificially in sufficient quantity to analyze and detect by other than radioactive means. The continuation of this work is being undertaken by Professors Harnwell and Smyth with the purpose of producing larger quantities of this heavy hydrogen and of attempting to detect by the same method a second possible variety of helium of mass three instead of the ordinary sort with mass four. Dr. Bleakney reported the discovery to the American Physical Society meeting at Washington.

The positive discovery of the third kind of hydrogen, 300 per cent. as heavy as the ordinary kind, will rank with the discovery in 1931 that there is a double-weight hydrogen, named deuterium.

PENETRATING RAYS FROM THUNDER-CLOUDS

PENETRATING radiations resembling cosmic rays, but "softer," are thrown upward into the air from the tops of thunderstorm clouds, like spray from the tops of waves. They come to earth again to the eastward of the cloud, drawn down by the earth's magnetic field.

These radiations, which are made up of speeding negative electrons, were described before the meeting of the American Geophysical Union by Dr. B. F. J. Schonland, of South Africa, who is visiting in the United States.

Dr. Schonland states that when he began his investigations of penetrating radiations caused by lightning, he supposed that he would find electrons poured directly earthward as well as upward into the higher levels of the air; but this proved not to be the case. He has found that lightning-engendered radiations can influence cosmic-ray detecting instruments as much as a thousand miles away from a thunderstorm, and he stated that another investigator claims for them an even greater radius of action. But their effect is always felt to the eastward of the storm that gives them birth, never toward the west.

The research was undertaken with the idea of finding out whether cosmic rays were entirely the product of thunderstorms, as one student of the subject had claimed. Dr. Schonland is convinced that this is not the case; nevertheless, there are enough lightning-caused penetrating radiations to make it necessary for investigators of cosmic rays to take them into account, if their figures are not to be falsified.

THE RELATIVITY AND QUANTUM THEORIES

THE unification of the relativity theory and the quantum theory was the subject of a lecture by Sir Arthur Eddington to the National Academy of Sciences. He took the universe as pictured in formulae by Einstein and others, himself included. He took the mathematical picture of the sub-atomic world of the quanta. He brought them together.

According to Sir Arthur, it is difficult, nearly impossible, to put what he has done into words. It is a matter of expressing the constants of the universe and of gravitation in terms of the electric charge and mass of the electron. The mathematical language of astronomy is translated into the language of sub-atomic physics.

One of the strange ideas used is that in the universe of relativity mass is associated with the curvature of space and that in a flat, purely Euclidian space there would be no mass or matter. To get at the mass in the realm of the quantum theory, Sir Arthur used what he called a "short cut." He determined the mass by means of the use of the famous uncertainty theory, which says that the mass of a particle can be known only if there is uncertainty about its position.

There is a limit to the uncertainty of the position of a particle in the universe even if it is totally unknown. As an analogy he pointed out that the authorities might know absolutely nothing about where an escaped criminal is located, but they can locate him within some 12,000 miles because he must be on the surface of the earth. So Sir Arthur locates the particle whose mass is desired as somewhere in the universe, with a certainty of a few thousand million light years. With this limit to the uncertainty he is able to derive without the aid of experiment values of the electron and proton that agree closely with those obtained by experiment.

The electric charge on these particles originates in the division of the universe's mass into a large number of particles, Sir Arthur explained. The charge comes when there are at least two particles and it can not exist when there is only one.

There is one incidental philosophical observation from Sir Arthur's uncertainty procedure: "You can not produce complete ignorance."

The numbers 136 and 137 bob up in the intricate equations as specially significant and interesting numbers. They are expressions of the degrees of freedom involved, the ways that things can be considered and arise from out of the properties of the particles.

Sir Arthur gave credit to Professor P. A. M. Dirac, of England, and Dr. Hermann Weyl, now at the Institute for Advanced Study, Princeton, for their work upon the problem of uniting the relativity and quantum theories.

PROTECTION AGAINST PARROT FEVER

THE heroic sacrifices of life and health made by workers in medical laboratories throughout the world have aroused universal sympathy and admiration. News that the hazards faced daily by these men and women are gradually being lessened is particularly heartening.

The latest achievement in this direction is protective vaccination against psittacosis or parrot fever, just announced by Dr. Thomas M. Rivers, of the Rockefeller Institute for Medical Research in New York City.

Seven laboratory workers have already been vaccinated. Five or six doses of live virus varying in strength from 10,000 to 10 million times the dose that will kill a mouse were injected into their muscles in order to establish in these workers a resistance to the dangerous organism which causes the disease.

Parrot fever has been particularly hard on laboratory workers who promptly met the challenge of this new and mysterious malady when it broke out all over the world in 1929, following the distribution of diseased parrots from Argentina and Brazil in that year.

Eleven cases developed at the U. S. Public Health Service's National Institute of Health in Washington. Nearly twenty more have been reported from laboratories throughout the world. The valiant work of these and other investigators has enormously increased the scanty knowledge of the disease held prior to 1929.

Now as a crowning touch comes vaccination against it for the laboratory workers, at least. With protection achieved for these key men in the fight against the disease, means of protecting the rest of the population, particularly bird-fanciers, pet-owners and pet-shop salesmen who are most exposed to the danger, may be expected to follow soon.

It is not so long since vaccination against dreaded yellow fever was achieved by Dr. W. F. Sawyer and associates of the Rockefeller Foundation. As a result, the group of men and women investigating this disease in its tropical breeding places, and also explorers, missionaries and others whose busines takes them to the yellow fever zones of the world may be assured of protection.

Rocky mountain spotted fever is another highly fatal malady that has taken a high toll among laboratory workers. Protective vaccination against this has been achieved by officers of the U. S. Public Health Service. Here, as in the case of yellow fever, and presumably psittacosis for the present, vaccination of large populations is not practicable but at least those most in danger of contracting the disease in the course of their daily occupations may be protected.

CLIMATE AND CULTURE

SEA-TEMPERED winds from the cool northwest hold people to a high level of efficiency, make for rapid reproduction and stimulate ambition.

Climates like those of the sea-fronting nations of northwestern Europe, and of the northeastern United States and the Puget Sound region, were held up as best for the development of a high civilization by Dr. Ellsworth Huntington, research associate in geography at Yale University, in an address before a sectional meeting of the American Chemical Society.

"The best condition for man is summer weather with an average day and night temperature of about 64 degrees, which means up to 70 or more by day. This is the best temperature for physical health. Although we are unconscious of it, the birthrate shows that reproduction takes place more rapidly at this temperature than at any other.

"But among people who live as we do, mental activity is greatest when outdoor temperature averages much lower. Even though we work indoors, the outdoor temperature affects us so that we work best in weather averaging about 38 degrees, that is, when there are mild frosts at night.

"Temperature is by no means the only factor in producing the climatic optimum. We need plenty of atmospheric humidity except at high temperatures. Then, too, we also need plenty of variability from day to day, although great extremes are not desirable.

"It is perfectly possible that some day the progress of invention will cause a still colder climate to have the

most stimulating effect. Or perhaps a new knowledge of how to create the right conditions in tropical countries may make the warmer regions far more stimulating and healthful than is now the case. Nevertheless, for the present there is no reason to think that there will be any radical change."

THE THYROID GLAND AND ITS PART IN HEART DISEASE

THE pain of angina pectoris and congestive heart failure may be relieved in some patients immediately after operation for complete removal of the normal thyroid gland, Dr. H. L. Blumgart, of Harvard Medical School and Beth Israel Hospital, Boston, reported at the meeting of the American Society for Clinical Investigation.

Surgeons should not be misled by this immediate relief of pain, since its cause is temporary. Permanent relief is not possible until there has been time for the metabolic rate to be reduced as a result of removal of the thyroid.

This now famous operation was devised by Dr. Blumgart and Drs. S. A. Levine and D. D. Berlin to lessen the load of the overworked heart or weakened arteries in pumping and carrying the mass of blood to the tissues. The amount of work the heart must do depends primarily on the call of the tissues all over the body for oxygen. This in turn is governed by the thyroid gland which determines the metabolic rate or the rate at which the body processes requiring oxygen go on.

When this rate has been reduced consequent on removal of the thyroid, permanent relief of the pain is achieved, but until tests show that the rate has been lowered, patients should be kept at rest in bed, in spite of the fact that they feel much better.

This permanent relief was expected to follow complete thyroid removal, but relief was experienced by the patients much sooner than expected. Dr. Blumgart and Drs. A. A. Weinstein, D. Davis and J. E. F. Riseman have spent over a year studying this aspect of the treatment. They found that the immediate relief was due to the fact that the surgeon, in removing the thyroid gland, interrupts nerve pathways which carry painful sensations from the heart to the central nervous system.

"With this early relief that occurs before the metabolic rate becomes lowered there is probably no fundamental change in the heart condition," Dr. Blumgart explained. "So the importance of keeping patients in bed after the operation, in spite of their sense of well-being, until the metabolic rate falls, is to be emphasized."

ITEMS

SUN-SPOTS, which are beginning to freckle the sun's face again after a season of relative scarcity, appear to have an intimate connection with the occurrence of sharp fluctuations in the earth's magnetic field, causing trouble with telegraphic instruments and other upsets. So A. G. McNish, of the Carnegie Institution of Washington, stated, in the course of an address before the annual meeting of the American Geophysical Union. "When sun-spots are most numerous, magnetic storms occur most frequently," he said. "The storms temporarily change the earth's magnetism. After the storms are over, the earth's magnetism returns to its original condition, for which reason it is not possible to attribute the gradual long-time changes to the action of the sun." There appears to be some relation between sun-spots and the aurora borealis, and in turn between these dancing northern lights and the electric currents that flow through the earth. W. J. Rooney, also of the Carnegie Institution, discussed these phenomena. The most brillian auroral displays are ordinarily accompanied by the strongest electrical effects. At such times the currents are noted at observatories far to the south of the Arctic regions, and even on the magnetic equator itself.

RAIN brings down radium, washing it out of the air, G. R. Wait and A. G. McNish, of the Carnegie Institution of Washington, told members of the American Physical Society. But you need not go out with a bucket the next time it rains, for the quantity is exceedingly minute—to be measured only with delicate instruments that tell of the electrified or ionized state of the air. With such an instrument in the open near their laboratory, it was found that as the rain began the ionization of the air increased rapidly, to fall off again when it stopped. The decrease with time was of such a character, they said, "as to be explainable by assuming that decay-products of radium, principally radium B and radium C in equilibrium with it, are carried to the earth's surface by the rain.

BEFORE the meeting of the American Meteorological Society, J. B. Kincer, of the U. S. Weather Bureau, cast strong doubt on the hopes entertained by some of his fellow investigators that long-range weather forecasting may be made possible on the basis of cyclical or recurrent changes, possibly connected with sun-spot cycles. The Weather Bureau has made careful and open-minded tests of these methods, he said, but the results were "keenly disappointing. The matter is still being given consideration," he continued, "and claims made by persons not associated with the bureau are carefully and openmindedly investigated, but so far with no promise of success."

THE life span of cut flowers can be lengthened by keeping them in copper containers. This is the discovery reported by John Ratsek, floriculturist on the staff of the New York State College of Agriculture. Mr. Ratsek used in his experiments containers which are copper-plated with a recently invented electro-plating finish. He found that the copper added from one to three days to the life of roses, snapdragons, stocks, delphiniums, primroses, carnations and other popular varieties of cut flowers. In one test, poinsettias in the copper container lasted sixteen days, as compared to eight days for poinsettias in a tin container. In accounting for the copper having this effect, Mr. Ratsek explained that tests showed some of the copper from the plated containers dissolved in the water. The copper thus kept the water purer by hindering growth of bacteria and other organisms which cause flowers to decay.