

## SCIENCE NEWS

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### A NEW SOURCE OF PROTONS

A PLENTIFUL supply of atomic bullets for shooting at other atoms in the hope of transmutation and atomic energy release is assured by a Massachusetts Institute of Technology discovery.

A source of protons that is nine times as prolific as any previously known was devised by Drs. Edward S. Lamar and Overton Luhr, working in the new Eastman Research Laboratories. Protons are the positively charged kernels of hydrogen atoms and the most effective projective known to science for atom smashing.

Their new source is an electric arc operating in hydrogen at low pressure between an incandescent filament and a neighboring metal electrode. Ordinarily such an arc would produce ions of which about ten per cent. would be protons and the remainder molecular ions. However, by surrounding the arc with a third electrode maintained at a negative potential of a few hundred volts, the percentage of protons produced is immediately increased to approximately 90 per cent. Dr. Lamar and Dr. Luhr are hopeful of still further raising the percentage.

The new proton source will be applied to the 10,000,000 volt Van de Graaff direct current generator recently tested at the research station at Round Hill, Massachusetts. Dr. Karl T. Compton, who collaborated in the investigations out of which the Lamar-Luhr discovery arose, explained that protons speeded at 7,000,000 volts in the Van de Graaff generator are as effective as ordinary charged hydrogen molecules sped by twice that voltage, 14,000,000 volts. For this reason, the plentiful protons of the new source will be used as missiles when the giant generator is turned to the task of attempting the release of the enormous stores of energy locked within the atoms.

### THE WEIGHT OF THE NEUTRON

PHYSICISTS are attempting to determine the weight of the neutron, the fundamental particle of matter that a relatively few months ago was totally unknown. The present status of the neutron mass controversy was summarized recently by Dr. R. M. Langer, of the California Institute of Technology.

All agree that it is almost equal to the hydrogen atom, which is 1.0078 on the chemical scale, but it is most important to know whether the neutron is heavier or lighter and by how much. Small differences in mass make big differences in most other things.

The French workers, Dr. F. Joliot and Mme. Joliot, the daughter of Mme. Curie, assert that the neutron is heavier than hydrogen and equal to 1.012. This explains how protons break up into neutrons and positive electrons, and why the beryllium nucleus is stable. But Dr. Langer pointed out that these assertions are not yet to be accepted as facts and depend on questionable interpretations of experiments.

The English physicist, Dr. J. Chadwick, who discovered

the neutron with the aid of preliminary work by the Joliot, chooses the mass 1.0067, which is slightly lighter than hydrogen. His interpretations are well established, but the experiments are not very accurate. Dr. Langer believes this value is close but not necessarily exactly right.

A third group, represented by Professor E. O. Lawrence at the University of California, insists that the neutron is considerably lighter, namely 1.0006. This is claimed because some of the experiments seem to show that the deuteron is unstable and breaks up when it strikes other nuclei. Dr. Langer holds that it must yet be proved that there are no more probable interpretations of their work.

Dr. Langer contends that by far the most precise means of determining the neutron's mass is to use experiments on the disintegration of lithium with deuterons. This process has been carefully studied by Lord Rutherford, Dr. M. L. E. Oliphant and Dr. B. B. Kinsey in England. They measured the energy of the helium found in the disintegration. From their data, Dr. Langer calculated that the mass of the neutron is 1.0062, which is only 0.0005 less than Dr. Chadwick's guess. This small difference is, however, equivalent to half a million volts.

The mass 1.0062 would mean that the deuteron is stable, but would be easily decomposed, while the proton might very readily break up into a neutron and a positive electron. Until this question of the neutron's mass is decided, according to Dr. Langer, little progress can be made with the theory of the nucleus.

### "DEUTERIUM" OR "DIPLOGEN"

AMERICAN and British scientists do not agree on a name for the double-weight hydrogen atom, discovered in America and now the subject of intensive research in chemical and physical laboratories throughout the world.

Lord Rutherford of Nelson, the eminent British physicist, head of the famous Cavendish Laboratory at Cambridge University, in a Royal Society discussion upon heavy hydrogen, urged the adoption of "diplogen" as the name of the double weight hydrogen atom and "diplon" as the name of the nucleus or kernel of heavy hydrogen.

Professor H. C. Urey, of Columbia University, New York, one of the group of Americans who discovered heavy hydrogen, had already christened the atom "deuterium," and at the University of California the nucleus had been labeled "deuteron." Both these terms have been widely used in scientific publications in America.

The principal objection to the American terms lies in the phonetic similarity between deuteron and neutron. Neutron is the uncharged or neutral particle of nearly the same weight as a proton or ordinary hydrogen nucleus that was discovered about two years ago in Cavendish Laboratory. If those discussing these atomic particles have colds or do not speak distinctly, deuteron and neutron are easily confused in speech, according to Lord

Rutherford. In this contention he was supported by Dr. N. V. Sidgwick, Oxford reader in chemistry, who reported that at the recent Chicago meeting of the American Chemical Society he noticed much oral and auditory confusion between deutron and neutron.

Although the right of American discoverers to decide on the name is recognized, it was stated that the names diplogen and diplon were conceived as the result of consultations between British investigators when the existence of heavy weight hydrogen was suspected on theoretical grounds. This was before the American discovery.

Dr. Frederick Soddy, of the University of Oxford, who has investigated varieties of elements and who coined the word "isotope," protested against the idea that ordinary mass one hydrogen and the heavy weight hydrogen of mass two are really isotopes. He considers hydrogen and deuterium (diplogen) homologues like oxygen and ozone rather than true isotopes.

The British hailed the American discovery of heavy hydrogen as of great importance even though they did not agree with the proposed American nomenclature.

### COSMIC RAY INTENSITY AND AN EXPANDING UNIVERSE

A SERIOUS difficulty in the Lemaître hypothesis that the universe started as a monster radioactive atom that became the expanding universe is brought out by the researches of Professor P. S. Epstein, of the California Institute of Technology.

Professor Epstein's extension of the expanding universe theory has demonstrated that all events that occurred while the universe was young were low in energy compared with the same events taking place at a more mature time.

Abbé Georges Lemaître, now lecturing at Catholic University of America, suggested that the cosmic rays now bombarding the earth have survived from the primordial "explosion" of the universe. Professor Epstein finds from his extension of the expanding universe theory that cosmic rays are feeble the older they are, and that those emitted when the universe started as a small body have no energy. Just as ordinary light is reddened as it comes from the distant reaches of space, so cosmic rays are diminished in energy on their way to earth.

The expanding universe theory was originated by the Russian astronomer, A. Friedmann, and independently by Abbé Lemaître, and it was brought to the attention of the scientific world by Dr. Willem de Sitter, the Dutch astrophysicist, and Sir Arthur Eddington. Dr. Fritz Zwicky, of the California Institute of Technology, first pointed out that unless cosmic rays originate in our own part of the universe they would cease to be vigorous enough to penetrate through our atmosphere.

The considerations about the age of cosmic rays are considered one further argument against the short time scale, of the order of 2,000,000,000 years, advocated by most of those who favor the theory of the expanding universe.

### PLANETARIUM TO REPRODUCE ANCIENT SKIES

THE night skies seen from Palestine in the year 5 B. C., at the time of the birth of Christ, are being shown in the Fels Planetarium of the Franklin Institute for two weeks, beginning on Sunday, December 17.

Visitors will first see the familiar December evening sky of Philadelphia. Then they will be shown the sky of present-day Palestine, which is about 32 degrees north latitude, or eight degrees south of Philadelphia. The effect of "precession," by which the north pole of the heavens describes a large circle in the sky during the course of 25,800 years, will then be shown.

The sky will be "set back" nearly two thousand years, and a night in December, 10 B.C., will be displayed. Because of the precessional change, the Southern Cross could then be seen from Palestine, and from points as far north as 37 degrees latitude. Now it is not seen north of 27 degrees, which is the latitude of southern Florida.

As the planets are then caused to move in the orbits similar to those they actually took at that distant time, the planetarium visitors will see Jupiter and Saturn draw into conjunction, as they did three times during the year 7 B. C. Some Biblical authorities have ascribed the origin of the "Star of Bethlehem" story to this phenomenon.

The exact date of the birth of Christ is not definitely known, but it is supposed that it was between 7 and 5 B. C., and the planetarium demonstration will conclude with the stars and planets the way they appeared on the night of December 24 of the latter year.

Though the planetarium instrument can reproduce the precessional cycle, taking nearly 26,000 years, in a minute, the ordinary yearly motions of the sun, moon and planets are not speeded up accordingly. To set them back 1940 years, at the rate of a year in seven seconds, the fastest of which the instrument is capable, will require nearly four hours.

### THE PRODUCTION OF VITAMIN B<sub>1</sub>

A METHOD for obtaining pure vitamin B<sub>1</sub> in large quantities has been developed by Drs. R. R. Williams and Walter H. Eddy, Teachers College, Columbia University. Chemical details of the method are given in a report to the Carnegie Institution of Washington.

By this new method, which is still in process of improvement, yields of from 250 to 300 milligrams of vitamin in crystalline form have been obtained from 50 kilograms of rice polish. While this amount seems very small when considered in terms of large scale production of ordinary substance, since 100 milligrams is only one and a half grains, roughly, and 50 kilograms is over 100 pounds, it represents from five to fifteen times the yield obtained heretofore by other investigators.

Lack of this vitamin causes nervous disorders, among them beri-beri. While the amounts necessary for health can be added to the diet by ordinary foods such as whole grain cereals, chemists need to have rather large supplies of it in crystalline form for further investigations as to

its chemical composition and effects on the body. Drs. Williams and Eddy hope that by their method, several steps of which have been carried out on a large scale according to a factory type of operation, they will be able to make the vitamin available in quantities of several grams.

### SUGGESTS BASAL METABOLISM TESTS FOR HOSPITAL PATIENTS

EVERY patient entering an American hospital in the future will have, in addition to routine tests of his pulse, blood pressure and certain other body fluids, a test of his basal metabolism, if the suggestion of Dr. Francis G. Benedict, director of the Carnegie Institution's nutrition laboratory, is followed.

This test is widely used at present to determine the functioning of the thyroid gland which plays an important rôle in governing the rate of metabolism. All interchanges of energy in the body are grouped under the general name of metabolism, and the energy of mere existence is called basal metabolism, one authority has said in explaining this complex subject.

Dr. Benedict points out that the study of basal metabolism has been one of the major activities of the nutrition laboratory. He finds that almost all well-established American hospitals to-day have their metabolism section, but for the most part the tests are made chiefly on sick persons as an aid to diagnosis. In Europe, however, he found that this test is very little used.

In suggesting that the next logical step for American hospitals is to make the test a routine procedure on all patients, he reported that in the nutrition laboratory there has been devised an apparatus which makes possible the measurement of basal metabolism without requiring unusual skill on the part of the laboratory technician.

Departing somewhat from the study of human metabolism, investigations are now being made in the laboratory of the metabolism of the white rat, the rabbit, the hibernating marmot or woodchuck, the pigeon and the dove, large domestic animals, the chimpanzee and a species of monkey.

Dr. Benedict points out that the perturbed metabolism of sick humans is often paralleled by the normal metabolism of some animal, and hence one can not stress too greatly the importance of a better understanding of the metabolism of various animals.

### ITEMS

WINTER began officially at 1:58 A. M., Eastern Standard Time, on December 22. At that moment, according to data furnished by the Nautical Almanac Office of the U. S. Naval Observatory in Washington, the sun reached the farthest south position of the year, which is called the winter solstice. As seen from Washington, the sun at noon on this day was about 28 degrees above the southern horizon. Because the sun is so low in the sky, its rays of light and heat strike the earth at a grazing angle, and are less concentrated than in the summer time, when it is about 75 degrees high at noon. This makes for the cold weather which northern countries are now beginning to experience. When the sun is low in

the northern hemisphere, it is high in the southern, so the winter solstice marks for the people of Australia and South Africa the beginning of summer. Their cold season comes during our summer months.

EXPERIENCE with a new anesthetic which is injected directly into the blood and which may prove as valuable as ether for certain types of surgical operations was reported by Dr. Gavin Miller, of Montreal, to the Canadian Medical Association. The new anesthetic is called evipan and was produced by a German pharmaceutical manufacturer. It has been tried extensively in Germany and England. Only one death was attributed to the anesthetic in over 20,000 cases in which it was used. Chemically, evipan is known as the sodium salt of N-methyl-C.C.-cyclohexenyl-methyl-barbituric acid. The anesthetic, injected directly into the blood-stream through a vein in the arm, produces a deep, normal sleep within thirty seconds. The operation can be started immediately. After the operation the patient awakens easily and gradually without any unpleasant after-effects. In Dr. Miller's experience, evipan is more effective if morphine or a similar drug is given first.

HEAT rays of extra-long wave-lengths, and their reactions upon striking the ozone layer in the upper levels of the atmosphere may have a peculiar significance in the earth's loss of heat to outer space, Dr. Charles G. Abbot, secretary of the Smithsonian Institution, informed his Board of Regents at their annual meeting on December 14. Among the forward steps in research conducted at the institution was the development of an especially sensitive radiation-measuring device for detecting and recording these long wave-lengths. The acquisition during the year of over a third of a million new specimens for the U. S. National Museum was another item reported by Dr. Abbot; the exact count was 348,012. They included such diverse things as the skull of a bowhead whale, several important art collections, botanical specimens from all over the world, objects of South American, Philippine and African workmanship, and a number of meteorites. At the National Zoological Park, over 1,300 animals were added, offset by 1,000 lost through death and exchange, leaving the zoo's population at the end of the year at 2,496 animals.

In a few weeks, there will be at Columbia University a supply of about 400 grams (approximately a pound) of heavy water, similar to familiar ordinary water but with practically every hydrogen atom in it double the weight of ordinary hydrogen. Professor Harold C. Urey, of Columbia University, and one of the group that two years ago discovered the existence of deuterium or heavy hydrogen, described to the American Chemical Society's New York section the production of heavy water on a scale and at a low cost hitherto unattained. Water particularly rich in heavy hydrogen is obtained from a commercial water electrolysis plant and concentration is effected in a laboratory plant that produced eight to ten grams (approximately one third ounce) per day. The production cost is about \$15 a gram, which is about a tenth of the costs reported from other laboratories engaged in similar heavy water production.