SCIENCE NEWS

Science Service, Washington, D. C.

DISINTEGRATION OF THE ATOMIC NUCLEUS BY COSMIC RAYS

THE incessantly penetrating cosmic rays that bombard the earth from the depths of outer space smash the hearts of atoms and let loose speeding particles, Dr. Robert Andrews Millikan, of the California Institute of Technology, announced in New York upon his return from a two and a half months' good-will trip to Germany and other parts of Europe.

Disintegration of the atomic nucleus by the cosmic rays was discovered by Dr. Carl D. Anderson, an associate of Dr. Millikan at the Norman Bridge Laboratory of Physics at Pasadena, in research planned jointly by Drs. Millikan and Anderson. The results were communicated to Dr. Millikan while abroad so that he might discuss their import with Lord Rutherford, of Nelson, and other physicists who have been studying atomic disintegration at the Cavendish Laboratory, Cambridge, for the past decade.

Dr. Anderson's experiments provide the first scientific evidence that electromagnetic radiation can disrupt the innermost structure of matter. Artificial breaking down of elements has been accomplished in the past by the impact of alpha radiation from radium, which consists of rapidly speeding hearts of hydrogen atoms. Heretofore investigators have not had at their disposal x-rays or gamma rays of sufficient intensity or shortness to disrupt the tightly bound hearts of elements.

Cosmic rays, with energies of 100,000,000 to 300,000,000 volts, are extremely penetrating x-rays or gamma rays and provide an automatic tool for bombarding and smashing the atomic hearts. In his experiments Dr. Anderson found that cosmic rays knock both negative and positive electrons and protons out of the nuclei of oxygen and nitrogen. He used the Wilson cloud chamber apparatus in which the collision of cosmic radiation with atoms of gas is made visible by a line of small water droplets. The electrons or particles of electricity that are reemitted from the collision travel at immense speeds —99.9 per cent. of the velocity of light, which is 186,000 miles per second. The protons or hydrogen nuclei also are given great velocities equal to half the velocity of light, or 75,000,000 volt electrons. These values provide physics with new speed records.

Dr. Millikan predicted that Dr. Anderson's bombardment experiments would be useful in understanding the fundamental nature of matter. It is another demonstration that transmutation of the elements, long considered an alchemistic dream, is possible in some cases. In Dr. Anderson's experiment, hydrogen, the simplest of elements, is obtained from the gases oxygen and nitrogen; although the quantities are of no practical importance.

Intensive research on cosmic rays now in progress in Germany is confirming, Dr. Millikan found, his conclusion that cosmic rays come to earth with equal intensity from all parts of the the sky. Dr. E. Regener, of the University of Stuttgart, by sinking electroscopes to thousand-foot depths in the Bodensee, has extended and confirmed Dr. Millikan's own finding on the penetrating power of the most intense cosmic rays. Dr. Millikan visited Dr. Regener during his travel in German-speaking European countries as the guest of the Oberländer Trust. He also found Dr. F. Hoffman, of Halle, in complete agreement with him on cosmic rays.

THE PHOTO-ELECTRIC CELL IN AVIATION

THE photo-electric cell, magic eye of science, has penetrated blanketing fog with an effectiveness thousands of times that of the human eye and so gives promise of enabling the aviation industry to overcome one of its greatest handicaps.

This and other important facts about aviation light signals have been learned from studies at the General Electric Research Laboratory by Dr. Irving Langmuir, who first filled the vacuum of electric lamps with rare gases to make them shine brighter and last longer, and his associate, W. F. Westendorp. They reported results of their work before the annual meeting of the American Society of Mechanical Engineers.

A device was described which, it was said, will enable a photo-electric cell on an airplane to "see" through dense fog light beacons on the ground entirely invisible to the eye of the pilot and thus enable the pilot to hold to his course. Its operation depends chiefly on the fact that the photo-electric cell is thousands of times more sensitive to diffused light—and all light from the ground will be diffused by fog—than the human eye.

To make sure that this super-sensitive electric eye will report airplane beacons and not just any lights on the ground, Dr. Langmuir and Mr. Westendorp suggested feeding special beacons with a 1,000-cycle current so that they will give a rapidly flickering light. Since other lights use either a 60-cycle or direct current, it will be possible to isolate the 1,000-cycle signals and use only these for direction purposes.

Indicative of the extreme sensitivity of the cell is the fact that in full moonlight it can detect a diffused modulated light of an intensity only one thirteen-thousandth of that of a diffused flashing light just visible to the eye.

In order to determine how well this system would work, a special set-up of the photo-electric cell and amplifier was constructed in the laboratory.

FILTERABLE BODIES SEEN WITH THE RIFE MICROSCOPE

USING the new "super-microscope" invented by Dr. Royal Raymond Rife, of San Diego, Dr. Arthur Isaac Kendall, of Northwestern University Medical School, has seen for the first time the exceedingly minute moving bodies that apparently carry the life of bacteria when these are induced to "dissolve" into a form that will pass through the pores of the finest porcelain filter and

still remain alive and able to resume their microscopically visible bodies upon suitable treatment. The work was done at the Pasadena Hospital, and will be reported in the official publication of the California Medical Association, *California and Western Medicine*.

The material used by Dr. Kendall was a culture of the typhoid bacillus, ordinarily a fairly large germ, easily visible under the higher-powered lenses of a compound microscope. By feeding it on his recently-evolved "K medium," which apparently has the power of causing all visible bacteria to pass over into an invisible, filterable phase, Dr. Kendall induced the bacilli in his cultures to go through this change. Under the highest power of the ordinary microscope, he could see nothing moving in the fluid, except a swarm of rather active little granules that could be seen only as tiny motile points.

Examined with the Rife microscope, however, these points became plainly visible as small, oval, actively moving bodies, turquoise-blue in color. These appeared in all the cultures, and could be transferred from one culture to another through the fine-pored filters; so Dr. Kendall considers them to be the actual filterable forms of the typhoid bacillus.

He put them to another, more definitely crucial test. Reasoning that since they were all that were to be found in "K medium" cultures of more than eighteen hours' growth, he might find them in an intermediate state in younger cultures, he tried examining samples from cultures exactly eighteen hours old. In these he found both full-sized bacilli still unchanged, and his small, turquoise-blue bodies, and in addition there were peculiarly altered bacilli within whose substance the turquoise-blue bodies could be seen. These he holds to be bacilli caught in the act of changing from the filterable to the non-filterable phase.

This visual demonstration of the hitherto invisible, living and moving particles of the filterable phase of a bacillus is hailed editorially by *California and Western Medicine*. Of Dr. Rife's microscope the editorial says: "Whereas our present microscopes magnify from one to two thousand diameters, in this new microscope we have an instrument for which a magnification as high as seventeen thousand diameters is claimed. This is certainly a long stride from the initial efforts of Van Leuwenhoek, whose simple instrument may be said to have laid the foundation for the science of bacteriology which later came into being; and by means of which science much of the world's progress in man's conquest of the infective and other diseases has been made possible."

In the forthcoming article only meager details of the new microscope itself are given. It is made known, however, that all the optical parts are of quartz instead of the usual glass, that attachments make possible spectroscopic examinations and motion pictures of the material under the lens, and that magnifications up to seventeen thousand diameters are possible. The work on Dr. Kendall's filterable typhoid germs was done at a magnification of five thousand diameters.

The light used with Dr. Rife's microscope is polarized, that is, it is passed through crystals that stop all rays except those vibrating in one particular plane. By means of a double reflecting prism built into the instrument, it is possible to turn this plane of vibration in any desired direction, controlling the illumination of the minute objects in the field very exactly. Further details regarding the mechanical construction and the optics of the sensational new instrument are promised at an early date.

BLOOD TEST FOR CANCER

A NEW method of detecting cancer in its early stages has been developed by Dr. Hans Jacques Fuchs, member of the physiological institute of the Veterinary University of Berlin. An account of the new method has been given by Dr. Fuchs to a Science Service correspondent. Details will be published in a few months in a German scientific journal.

So far, two thousand cases have been successfully diagnosed by the new method, the diagnosis being confirmed by operation or dissection. The method also makes it possible to determine the presence or absence of cancer when an infectious disease occurs at the same time. Further, it is claimed that by this method the success of surgical or radiological treatment of cancer can be controlled.

The new method depends on the digestion of serum from the blood of a suspected cancer patient with fibrin prepared from the blood of a normal person and with fibrin from the blood of a person known to have cancer. The digestion goes on for ten hours at a temperature of 104 degrees Fahrenheit. The protein is then removed from these samples and the amount of non-protein nitrogen present in each is determined. Depending on the amount of non-protein nitrogen present, it is possible to make a diagnosis as to whether the suspected case is one of cancer or not.

The new method is the result of five years of incessant research work during the course of which Dr. Fuchs had to make a number of pieces of special apparatus in order to achieve the necessary exactness in his determinations. The method also marks the first time that a chemical determination of a serological process has been made.

A certain diagnostic test for cancer, such as this is hoped to be, will be particularly valuable because modern methods of treatment by surgery and radiation are chiefly successful only in the early stages of the disease. When cancer attacks the internal organs, it is nearly impossible to detect it in its early stages by present methods of diagnosis.

A NEW ANESTHETIC

A NEW general anesthetic for use in surgical operations, which is more rapid and efficient than ether, chloroform or the anesthetic gases, has been discovered in accordance with a prediction of Dr. C. D. Leake, professor of pharmacology at the University of California Medical School, according to an announcement made on December 4 by Dean Langley Porter.

The new anesthetic is called divinyl oxide. It is chemically related to ether and ethylene and will probably be given in the same way that ether is. However, it is superior in several ways to these anesthetics.

Recovery is more rapid when divinyl oxide is used for an operation than when ether is used. There is less excitement and less nausea with the new anesthetic. There is also less irritation of the lungs and less disturbance of the body's chemical equilibrium. The heart action is not greatly changed. Divinyl oxide is a liquid which boils at a low temperature. It is inflammable and as explosive as ether.

Associated with Dr. Leake in the work leading to this discovery were Mrs. Mei-Yu Chen Mai, now in Peiping, China; Dr. P. K. Knoefel, fellow of the National Research Council, and Dr. A. E. Guedel, Los Angeles anesthetist. While investigating the anesthetic action of ether and ethylene at the University of Wisconsin, Dr. Leake predicted that divinyl oxide, the chemical relative of these substances, would prove valuable. At his request, it was produced in a chemically pure form by Dr. R. T. Major and Dr. W. L. Ruigh, of Princeton University, and the Merck Laboratory for Pure Research at Rahway, N. J. It was then given a trial and as a result the world has a new anesthetic.

Divinyl oxide may be obtained from the common garden variety of leek, but only by a laborious process. It has been found more practicable to obtain it by another method. Clinical evaluation of the new anesthetic is still proceeding at the University of California Hospital under the supervision of Dr. H. C. Naffziger, professor of surgery, and Dr. D. Wood.

The experiments leading to this discovery were made possible by financial aid from public-spirited citizens, chiefly the Christine Breon Research Fund.

ITEMS

THE cosmic rays have been seen. At least, the straight paths along which they travel have been made visible in experiments reported to the American Physical Society by Dr. L. M. Mott-Smith and G. L. Locher, of the Rice Institute, Texas. They believe, from their observations of these thin straight tracks of rapidly moving particles, that bullet-like corpuscles must form the problematical cosmic rays. The Wilson cloud expansion chamber, which has been used to investigate colliding atoms, was used in these experiments to make visible the path of the rays. They appear as a train of water droplets in a strong light.

PHOTOGRAPHIC plates sensitive to ultra-violet light will shortly be made commercially by a new process, Dr. C. E. K. Mees, of the Eastman Kodak Company, has reported to the Optical Society of America. "Schumann" plates used for this purpose till now were difficult to make and had to be prepared by hand. They had a coating either entirely free from gelatine or containing only a small trace of gelatine to bind the silver bromide together. R. E. Burroughs, of the staff of the Kodak Research Laboratories, tested a large number of organic substances and found the most suitable to be ethyl dihydrocollidine dicarboxylate, which fluoresces strongly in the ultra-violet. This substance can be applied in organic solvents, from which it crystallizes in microscopic crystals over the surface of the plate, these crystals being easily removed before or during development of the plate.

A NEW type of frozen fruit is being developed by the Food Research Division of the Bureau of Chemistry and Soils, Department of Agriculture. By pulping the pitted fruit, adding a sugar syrup, mixing it thoroughly and then freezing it at very low temperatures, department chemists have developed this frozen fruit product which they claim has a remarkably smooth texture and fully retains the original flavor. The experiments already have been made with excellent results with several varieties of fruit, and it is hoped that later results will measure up to the promise of these preliminary experiments. If so, ice-cream manufacturers and soda fountain operators will have a new and highly desirable fruit base, which also will be available for direct consumption in the frozen state.

MICHIGAN forest fire fighters last season developed a system of obtaining water for fighting ground fires by drilling shallow wells when no other near-by source was available. On many occasions it was found possible to sink a well from three to eight feet into the ground in a short time and thus obtain sufficient water to keep a ground fire or a muck fire under control. The use of this system, of course, depends upon the height of the water table. When it is low the pump system can not be used, but in ordinary seasons it has been found that a well point sunk a few feet into the ground will furnish enough water to fill portable tanks and pails. An ordinary "pitcher" pump or a gasoline pump is used to lift the water to the surface.

NEXT summer's grasshoppers are being fought this winter by the U. S. Bureau of Entomology. A survey is now in progress in the 'hopper country; this will be completed early in December, and it will then be known what steps will be needed to prevent a serious outbreak in the West and Northwest next summer. The normal method of stopping an outbreak of grasshoppers is to distribute baits of arsenic-poisoned bran where the young insects crawl the thickets, before they get their wings and move over a wide territory. The present survey should show where it will be necessary for private owners and state authorities to lay in larger supplies of the munitions of chemical warfare.

THE radium content of the pitchblende ore newly discovered in the Great Bear Lake region of Canada, has been incorrectly reported (see SCIENCE SUPPLEMENT, November 13, 1931). The pitchblende ore bears about $2 to $6 of radium per pound of ore. Assays of ore by the Mines Branch Laboratories at Ottawa showed between 71 and 213 milligrams of radium per ton. Assuming radium valued at $70,000 per gram, this is $5,000 to $15,000 radium gross value to the ton of ore.