SCIENCE NEWS

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RADIOACTIVE DISINTEGRATION

A NEW theory of why radium spontaneously explodes and disintegrates into other chemical elements was proposed by Professor Werner Heisenberg, the young German originator of quantum mechanics and the principle of uncertainty, who lectured at the summer physics symposium of the University of Michigan.

Professor Heisenberg visualizes the heart of the atom made up exclusively of protons, the positive particles, and neutrons, the newly discovered close combinations of proton and electron. Old ideas had the atomic nucleus built of protons and electrons, but Professor Heisenberg holds there are no electrons or negative units in the atomic hearts except combined with protons to make neutrons.

He explains radioactivity by the fact that there are too many neutrons in relation to protons in the hearts of heavy elements. They are unstable. At intervals, this unstability causes a neutron to burst and out rushes an electron which is discharged from the atom as a beta particle. The proton partner of this electron remains in the nucleus. At other times the atom gets rid of mass by ejecting a bundle of two neutrons, or two protons combined with two electrons, which are equivalent to a helium heart, and smash outward in the form of an alpha particle.

This disintegration continues with radioactive elements changing into lighter ones until they reach a stable state as some lighter element. Radium in this way turns into lead.

This new Heisenberg theory provides the first satisfactory explanation of the mechanism of radioactivity. Under the Heisenberg theory the number of protons in each nucleus is equal to the atomic number, while the proton and neutrons together determine the atomic weight.

Professor Heisenberg, who came to America from the University of Leipzig especially for the University of Michigan lectures, will publish the details of his theory in the *Zeitschrift für Physik.*

THE STRUCTURE OF THE ATOM

COBALT of atomic weight 57, manganese of atomic weight 53, and vanadium of atomic weight 49 are predicted in a letter to *Nature* by Dr. James H. Bartlett, Jr., young American physicist and fellow of the National Research Council, through the use of a new theory of atomic structure in which neutrons and protons only are used as building blocks of the nucleus.

The normal atomic weights of cobalt, manganese and vanadium of the sorts now known are 59, 55 and 51, respectively. Atoms of different weight but having identical chemical behavior are known as isotopes.

The neutron was identified as an entity only a few months ago. It is a close combination of an electron and a proton. Older theories of atomic structure considered the hearts of atoms as built of protons and free electrons, but the discovery of the neutron has led to the theory that electrons occur within the nucleus only as parts of neutrons. Starting with a helium nucleus and adding alternately a neutron and a proton, Dr. Bartlett obtains all the elements in the chemical table up to oxygen of atomic weight 16, mainly, lithium 6 and 7, beryllium 8 and 9, boron 10 and 11, carbon 12 and 13 and nitrogen 14 and 15. Beyond oxygen, owing to a change in the arrangement of the "bricks" within the inner shell (two neutrons being more stable in the central field than a neutron and a proton) the order of addition becomes: neutron, neutron, proton, proton, and repeat. This gives oxygen 17 and 18, fluorine 19, neon 20, 21 and 22, sodium 23, magnesium 24, 25, 26, etc.

Scientists have not been slow in making use of the neutron in their schemes of atomic structure. Professor Werner Heisenberg, distinguished German physicist, will shortly publish an atomic model with neutrons and protons only as building parts. M. Francis Perrin, of Paris, son of the well-known French physicist, Jean Perrin, has suggested a scheme in which alpha-particles are used in addition to neutrons and protons.

THE ARTIFICIAL DISINTEGRATION OF OXYGEN

OXYGEN has been artificially disintegrated by bombardment with neutrons in experiments at the famous Cavendish Laboratory at the University of Cambridge.

Oxygen is the common gas of the air that all of us breathe and the recently discovered neutrons are fundamental particles of matter, close combinations of proton and electron.

The disintegration is announced in a communication to *Nature,* by Dr. N. Feather, of Cambridge.

Photographs were obtained of the recoil and paired tracks of the results of the disintegration produced in an oxygen-filled expansion chamber. Polonium and beryllium at the center of the chamber provided the neutrons which hit and smashed the oxygen atoms.

The capture of the incident neutron seems likely in all observations made by Dr. Feather and he concludes that the disintegration particle is almost certainly an alpha particle or the heart of a helium atom.

The results show an absorption of energy and confirm the suggestion made recently by Mme. Curie that a small fraction of the beryllium radiation has a higher energy than the previous upper limit.

Although Lord Rutherford, in 1919 and succeeding years, performed the first artificial disintegrations of a number of elements, notably nitrogen, by bombardment with alpha rays, he did not break down oxygen. His colleague has now done so by using neutrons.

MOLECULE MODELS

STEEL balls of various weights, held together by springs to represent chemical attractions or "bonds," are helping chemists and physicists to understand the work-

ings of molecules where the problems have become too complex for even modern mathematics.

At the meeting of the American Chemical Society at Denver, Professor Donald H. Andrews, of the Johns Hopkins University, showed how laboratory models are helping to give a better working idea of what goes on in the submicroscopic world of chemical units.

The steel balls represent the nuclei of atoms. The surrounding planetary systems of electrons are ignored for the purposes of the experiment. It is all right to ignore the electrons, for most of the mass of every atom is concentrated at its nucleus.

Shaken at various speeds by a vibrating machine, these giant "molecules" move practically as rigid units, indicating a state of no chemical or physical activity within the molecule. But at certain critical speeds of shaking, the attached balls dance violently on their springs. And when these speeds are reduced to their equivalents in "exciting" wave-lengths of light, they are found to correspond closely to the stimuli necessary to cause the atoms of molecules to produce the light rays photographed in the so-called Raman spectra, by which molecules "sign their names."

The first model made was the very simple one of water: one atom of oxygen, two of hydrogen. Other relatively simple molecules have also been "made," such as methane (one carbon, four hydrogen), carbon tetrachloride (one carbon, four chlorine), benzene and toluene, which are slightly more complex. Really complicated molecules have not yet been modeled, but the work is going forward.

SPOTTED FEVER

ALL farmers in the area around the national Capital will be vaccinated against Rocky Mountain spotted fever next spring, if the U. S. Public Health Service is able to carry out its present plans. Every year some two hundred cases of this disease occur in the District of Columbia and adjacent states.

Officers of the U. S. Public Health Service, who have successfully fought the disease in Bitter Root Valley, Montana, where it first appeared, have recently found that a certain variety of tick, which abounds in this neighborhood, also carries the germ of the disease. Farmers, holiday-seekers and others who get into the bushes and high grass of the surrounding countryside are liable to contract the disease through being bitten by infected ticks.

The infected area contains a population of about four million. It is impossible to vaccinate the entire population of this area, as has been done in the Bitter Root Valley which has a population of only a few thousand. Furthermore, most people in the Washington area never get into the country where they would be exposed to the disease. The U. S. Public Health Service has warned them that if they do go into the country, they should keep away from bushes, trees and weeds, and watch for the ticks, picking them off as soon as possible. But for the farmers of the area who must be constantly exposed to the danger, the federal health officers hope to be able to offer immunity to the disease through vaccination.

At present the supply of vaccine against Rocky Mountain spotted fever is small. It is both expensive and dangerous to make. No commercial firm will handle it. Several of the federal health workers lost their lives in the production of the vaccine at the Montana laboratory. The vaccine gives immunity to the disease for about one year, and would be given in the spring in the Washington area, as that is the beginning of the season when the infected ticks appear. The end of this season's outbreak in the East is expected within the next two weeks, as at that time the cooler weather will have killed off most of the ticks.

Meanwhile, persons in the country are warned to pull off the ticks as soon as possible after they attach themselves. It is possible to be bitten by an infected tick and not to contract the disease, particularly if the tick has not been on the body very long. But if the tick has stayed on until it becomes engorged with blood and then dropped off by itself, the person stands a good chance of contracting the disease.

Rocky Mountain spotted fever has been prevalent in the Washington area since 1909, although it was not recognized as such until recently. But clinical records show that cases of the disease occurred as long ago as then. From sixty to ninety out of every hundred persons who get the disease die of it in the West. In the East it seems to be slightly milder, and the death-rate is between sixty and eighty per cent. An attack of the disease gives some immunity to subsequent infections, but it is not known how long this immunity lasts. The vaccine which protects against it was developed by Dr. R. R. Spencer, of the U. S. Public Health Service.

THE HYDROELECTRIC POWER PROJECT IN SOVIET RUSSIA

DNEPROSTROY, the hydroelectric power project of Soviet Russia, which was dedicated on August 25, can be described only with superlatives, so far does it exceed similar undertakings in size and difficulty of accomplishment. It is being completed on the Dnieper River in the heart of a region which electricity from this and smaller plants is expected to change into an industrial Utopia.

From an installed capacity of 756,000 horsepower, abundant electricity will be available to smelt iron and other metals and to operate chemical industries. Water is to be pumped to irrigate hundreds of thousands of hectares of rich, but drought-affected, steppe. Steamers from the Black Sea, 200 miles down the Dnieper, will be able to penetrate hundreds of miles farther inland because the dam, and locks built with it, overcome obstructing rapids.

The cost of the dam, power plant, locks and necessary bridges is approximately 220,000,000 rubles or $110,000,000. Three and one half million dollars was spent for construction equipment alone. It is estimated that an additional 620,000,000 rubles will be consumed in developing the industries that will depend on the new source of power. The dam is the largest masonry structure ever built to impound water and was finished six months ahead of schedule.

This tremendous project was a victory for American methods, because both American and European engineers submitted plans and actually tested them before the final contracts were let. The Europeans intended to use the most hightly developed automatic construction machinery while the American estimate contemplated employing ordinary steam shovels, concrete mixers and railways built to Soviet standards. Foundation work on the dam was begun on one side of the river by the Europeans working as they preferred and on the other side by the Americans employing their methods. It took only a few months for the Soviet officials to decide in favor of the Americans, Colonel Hugh L. Cooper and his organization, and to give them the remainder of the work. The rural Soviet laborers worked more successfully with the simpler American machinery.

Yet, there was a labor problem in the Soviet Union just as there might have been in America. Contrary to wide-spread belief, the government did not make the workers stick to the job. They constantly migrated between farm and industry and often several hundred would leave at one time to go where they had heard they could make more money. Thus the turnover was unusually high, being about sixty per cent. annually. In order to reduce this figure the workers were given houses and comforts superior to those found in most American construction camps. At times as many as 50,000 were employed on the project.

Women worked, too, and were exceptionally efficient. They used surveying instruments and were machine operators, locomotive firemen and concrete placers as well as common laborers. They would often work half an hour after the whistle to perfect a task.

The dam is 3,350 feet long, including the frontage of the power plant, and 140 feet high to the crest of the spillway, above which water will rise as much as 30 feet during floods. This structure impounds a flow varying from 6,300 cubic feet per second during severe droughts to 835,000 cubic feet at times of large freshets. The latter figure represents the greatest flow ever encountered by a structure of this type, and the dam stood this test in 1931 before it was finally completed.

Six of the plant's nine power units, the largest ever built, are now being installed. The turbines, rated at 84,000 horsepower normal capacity and 100,000 horsepower under a maximum head of water, were made in this country. Five of the generators were built in the United States and the remainder are being constructed in the Soviet Union.

While Dneprostroy's normal generating capacity is 756,000 horsepower, it has a maximum or high water capacity of 900,000 horsepower. On account of irregular water flow it will be possible to operate only three of the nine turbo-generating units during the entire year. The world's next largest hydroelectric power plants are Muscle Shoals with a capacity of 610,000 horsepower, 260,000 horsepower of which has already been installed, and Niagara Falls with 430,000 horsepower.

ITEMS

THOUSANDS of lives may have been lost in an earthquake which occurred at about noon on August 14, Chinese time, in the interior of China, although news of the disaster may be delayed weeks and months in being reported to the outside world. An earthquake shock of at least moderate severity was registered on seismographs throughout the world at 11:39½ P. M., Eastern Standard Time, on August 13. Through data wired to Science Service and interpreted by the U. S. Coast and Geodetic Survey, it was found that the center of the disturbance was located in the Yunnan province of the Chinese interior at approximately 27 degrees north latitude and 103 degrees east longitude. This is an earthquake region and there are many inhabitants. It is a part of China known for its sliding mountains and it is probable than many lives were lost. It is south of the Kansu region of China in which destructive earthquakes occurred in 1920 and 1927. The 1920 quake caused 500,000 deaths. The 1927 quake was flashed to the world as a probable major disaster by Science Service's earthquake-reporting service two months before the news from the locality reached telegraph lines.

MORE than 28,000 meteoric flashes in the night sky were seen from more than 150 localities by several hundred observers who watched for the Perseid meteors early this month (August 10 to 12), it is indicated by reports received by Professor C. P. Olivier, of the Flower Observatory of the University of Pennsylvania, up to August 17. Professor Olivier is president of the American Meteor Society. More persons saw more meteors this year than any previous return of the shower of the famous Perseid "shooting stars," said Professor Olivier, praising the newspaper cooperation that inspired many laymen to make meteor counts and report them. Professor Olivier expects that later reports from the western coast and foreign countries will increase the record.

PERSEID meteors falling at the rate of 208 an hour was the record observation of a group of Columbia College students, at Dubuque, Iowa, who watched the recent meteor shower. Even on August 7, which was six days before the peak of the shower, a group of six saw 140 meteors an hour, while an individual observer recorded 80 an hour. The highest rate of 208 an hour was a group observation at 1 A. M. on August 12, when the rate seen by one person was 116 per hour. The observations were organized by Professor John Theobald.

THE dough of wheat flour that puffs and blows up energetically as it rises saves the digestive organs work. For the more a dough gases the more readily it converts its starch into sugar easily assimilated by the human body. Digestive organs convert all starch into sugar before it can be used as a building material. The relation between a flour's "gassing power" and its "diastatic activity," or ability to change starch into sugar, was discussed by M. J. Blish and R. M. Sandstedt, of the University of Nebraska, before the Detroit meeting of the American Association of Cereal Chemists. The terms "gassing power" and "diastatic activity" are frequently used interchangeably, although they are not strictly synonymous. Differences among flours in gassing power reflect variations not only in diastatic activity, but also in original sugar content.