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TRACING CHEMICAL ELEMENTS IN THE BODY

PROFESSOR VINCENT DU VIGNEAUD, head of the department of biochemistry at Cornell University Medical College, New York City, in an invited address before the meeting of the American Chemical Society in Baltimore, stated that atom-smashing experiments of pure research physics have given an unforeseen and inestimably valuable tool for studying the use of chemical elements in the body.

Out of atom smashing, which at first seemed important only in the realm of nuclear physics, has come the ability to make almost any chemical element radio-active so that it gives off detectable radiations. It is thus possible to feed these chemical elements to man and animals and study, step by step, their pathways through the human body. Out of this knowledge has come new facts never before known about the behavior of the body.

Studies of phosphorus in the body, most important for creating bony structure, have shown that 62 per cent. of the phosphorus absorbed goes into the bony structure within five days, said Professor du Vigneaud. These tests are so sensitive that scientists can detect .000,000,000,005 milligram (5×10^{-12}) of the material present.

Another experiment performed with radio-active sulfur, Professor du Vigneaud said, shows that the phosphate compounds of the brain were constantly being regenerated.

Not only are radio-active elements useful in tracing how the body uses its food but also the stable isotopes of chemical elements can be used as labels for body reactions. Thus the heavy kind of hydrogen of mass two, instead of mass one, has been employed to study the mystery of fat, cholesterol and protein metabolism. It was found that the fatty acids in the body were replaced about every three days in rats; a completely unsuspected finding. This same type of research, carried on at Columbia University, showed that fatty acids were converted, one into another, in the body. Thus stearic acid was found to turn into palmitic acid.

The use of the heavy-weight kind of nitrogen also has yielded knowledge that the breakdown of protein material in the body occurs much faster than previously supposed. Using heavy nitrogen of mass 15, it has recently been possible to follow through the transitions of the complicated amino acids in the body. These acids are the structural building blocks out of which body proteins are built up, Amino acids are also known to help to create the still-mysterious enzymes which serve as catalysts in the body to turn food products into actual body tissues.—ROBERT D. POTTER.

SEPARATING ISOTOPES TO TRACE CHEMICAL ELEMENTS IN HUMAN BODY

THAT swirling whirlwinds of heat waves constitute the newest method of separating isotopes of the chemical elements was announced at the meeting of the American Chemical Society by Drs. Arthur Bramley and A. Keith Brewer, of the U. S. Bureau of Chemistry and Soils, Washington.

Separating the chemically-indistinguishable forms of elements known as isotopes is a major goal of science, for by isotopes it is possible to trace the paths of atoms from one compound to another through the intricate chemistry of the body. By such "tracer" atoms a whole new frontier of physiology can be opened whose importance may be as great as the discovery of the microscope. The microscope enabled scientists to see individual cells of an organism; the use of isotopes enables them to study the individual atoms in those body cells.

Up to a year ago only pure isotopes of hydrogen and nitrogen were available in sufficient quantities to make possible important chemical and biological researches. The new method of thermal "whirlwinds," however, permits the concentrations of isotopes to be extended to other chemical elements. Professor Klaus Clusius, of the Institute of Physics and Chemistry at Munich, has recently obtained the isotopes of chlorine 99.4 per cent. pure. A modification of the Clusius method has been developed by the American scientists. Describing their method they said: "The separation tube consists of two concentric glass tubes placed in a vertical position, the inner tube being heated electrically to several hundred degrees Centigrade and the outer tube cooled. The net result of the gas motions occurring within the tube is that the light molecules are concentrated at the top of the tube and the heavy at the bottom. With this inexpensive and comparatively simple thermal device, marked separations of mixtures of gases have been obtained. It has been possible to obtain oxygen from air over 80 per cent. pure. The separation of the isotopes has been demonstrated; even for such heavy elements as chlorine where other methods are impractical the isotopes have been highly concentrated."—ROBERT D. POTTER.

FURTHER WORK WITH SULFANILAMIDE DERIVATIVES

CURE of tuberculosis, leprosy and influenza by chemical derivatives of sulfanilamide, medicine's new weapon against a wide variety of streptococcic infections, is a new hope offered to-day as a promise of intensive chemical research now under way.

Reported at the meeting of the American Chemical Society were studies which foreshadow such possibilities, spurred by the success with sulfanilamide. Dr. M. L. Crossley, research director, and E. H. Northey and Martin E. Hultquist, of the Calco Chemical Company, described their new discoveries, emphasizing that it was only preliminary work which offered no cures at the present time. They said: "Of the many compounds prepared, the compound N-one-dodecanoyl-sulfanilamide is the most outstanding. This compound can be pictured as a combination of sulfanilamide with part of a fat. It has the properties of both its parents in that it pene-

trates the fatty tissues of the body carrying the therapeutic properties of the sulfanilamide. In studies on experimental animals it has shown a definite superiority to sulfanilamide in treating streptococcic infections and tuberculosis. The preliminary tests on animals carried out by Dr. David R. Climenko in the division of pharmacological research of the Calco Chemical Company have shown the dodecanoyl product to be of a low order of toxicity in comparison with sulfanilamide.''

Massive doses of human tubercle bacilli injected into experimental guinea pigs produced only small local lesions at the site of the injection instead of generalized manifestations of the disease throughout the body. It has also been shown that low concentrations of the new sulfanilamide derivative inhibit the growth of the tubercle organisms, for 90 days in test tube experimental cultures.

A characteristic fact about the new form of sulfanilamide is its fat solubility. Tentatively it is suggested that this property may aid the drug in penetrating the fatty, waxy pellicle which surrounds the tubercle bacillus and which makes it impervious to many chemotherapeutic agents.

The drug does not cure tuberculosis in animals but rather acts to arrest the spread of the infection and localizes it at the site of entry of the tubercle bacillus. The tubercle bacillus is one of a group known as acid-fast organisms. The organism causing leprosy is another. ''In view of the promising results obtained with this drug in the treatment of experimental tuberculosis, it is suggested, and attempts will be made to demonstrate this experimentally, that the drug may be equally effective in the treatment of other diseases caused by the acid-fast bacilli, such as leprosy.''

Last year the same investigators reported other sulfanilamide derivatives which offered promise of curing virus diseases, in particular, influenza.

''The above dodecanoyl-sulfanilamide is but one of a large number of products studied in the comprehensive investigations in progress in these laboratories. It is hoped that out of this study will come effective therapeutic agents for the alleviation of disease.

''These preliminary results in animals do not in any way permit any conclusion at the present time as to their efficiency in the treatment of diseases in man. Further study is in progress and the results will be reported later.''

The Calco Chemical Company, where these findings have been obtained is—with the Monsanto Chemical Company—the nation's largest producer of sulfanilamide drugs. The drugs are sold in bulk to the various drug houses where they are packaged and sold to druggists and physicians.—ROBERT D. POTTER.

THE VITAMIN CONTENT OF MILK

PROFESSOR DAVID B. HAND, of the New York State College of Agriculture at Cornell University, reported to the American Chemical Society that making a vitamin in milk glow to a brilliant green color is the newest feat of science in estimating milk's content of this important dietary chemical known as riboflavin.

Riboflavin is the green coloring matter of milk whey. When blue light shines on the whey the riboflavin turns intensely green by fluorescence. By observing the intensity of the green light, the content of the riboflavin present can be measured. Previously it has been necessary to feed whey to animals and wait for them to grow measurably.

Sunlight is bad for milk, Professor Hand continued, because it causes the rapid destruction of vitamin C, which aids in preventing scurvy. Milk fresh from the cow has a good supply of vitamin C but by the time it is bottled and delivered most of the vitamin C content is gone.

Professor Hand and his colleagues, Paul F. Sharp and E. S. Guthrie, of Cornell University, have found that it is the presence of vitamin G in milk which accounts for the destruction of vitamin C by light.

''It seems strange that one vitamin should cause the disappearance of another,'' Professor Hand said, ''but it should be remembered that this only happens in the light and milk was never intended in nature to be exposed to light. Air or oxygen also takes part in the destruction of the vitamin C. The vitamin is stable if all dissolved air is removed from the milk.''

Scientists at Cornell University have developed methods for bottling milk in a vaccum so that it may still possess vitamin C when delivered to the consumer. Fresh milk contains enough vitamin C for each quart to suit the requirements of an average person per day.—ROBERT D. POTTER.

THE FORMATION OF NEBULAE

AN expanding universe has decreed that no more of the great star clusters or nebulae which dot the heavens are to be born. The bulk of the stars were formed inconceivably long ago by condensation from huge gaseous clouds of matter. The stars then grouped together to make the nebulae, in a universe whose linear dimensions were then 600 times smaller than they are to-day. Matter is spread too thin throughout the expanded universe now to make such star cluster formation possible any longer. These are the conclusions of Drs. George Gamow and Edward Teller, of the George Washington University, presented in a paper printed in *The Physical Review*.

Above a certain critical density value for matter in gaseous clouds, stars are formed by gravitational condensation. But that value has long since been passed as the nebulae, fleeing apart at enormous speeds, have spread out the universe's content of matter. The nebulae may be spreading apart in a space which is open, not closed as many previous universe theories indicate.

Previous theories have held that, because distant nebulae appeared more luminous, space closes in on itself. But this brightness may be due to the fact that the nebulae, which are so distant that it is usually impossible to see the separate stars of which they are made up, may be more compact in the earlier part of their existence. Because of the hundreds of thousands of years it takes light from them to reach the astronomer's giant telescopes, what we see to-day actually represents an earlier period of their existence.

Space is infinite and ever expanding, Drs. Gamow and Teller also conclude. Otherwise, they assert, it is impossible to account in this fashion for the formation of the great nebulae. The nebulae separated from each other about 1.8×10^9 or 1,800,000,000 years ago, it is calculated. The bulk of the stars were formed before that time and event.

STORING THE SUN'S ENERGY

STORE the now-wasted surplus sun-energy in underground silos as trapped heat, to be drawn out and used as needed, is the proposal of Dr. F. G. Cottrell, of Washington. Dr. Cottrell's suggestion is incorporated in a new report by Dr. Charles G. Abbot, secretary of the Smithsonian Institution, in which latest developments of Dr. Abbot's many years of research on direct utilization of sun-power are discussed.

The "solar-silo" scheme is exceedingly simple. There would be a deep, cylindrical, concrete-lined pit, filled nearly to the top with loose, dry sand, and "stoppered" with about ten feet of glass wool, an excellent heat insulator. To the top of the sand would run a branched inlet pipe, from a solar heater, of the focussing mirror type invented by Dr. Abbot. An automatically controlled pump would bring in heated air when the sun was shining, and stop at night or in cloudy weather. A second set of pipes, at the bottom, would draw off the heated air as needed. It is believed that the sand, under its thick blanket of glass wool, would retain its high initial temperature for perhaps many months.

Dr. Abbot's latest improvement in the solar heater itself has been an automatic control of the water-stream flowing through it, to be converted into steam by the mirror-focussed rays of the sun. It is now arranged to take in water more rapidly as the boiler becomes hotter, and to cut it off when lack of sunlight reduces available heat.

Another adaptation by Dr. Abbot of the solar heater principle is the development of a solar water distiller, for use in deserts, on remote islands and in other places where the natural water is unfit to drink. It makes it possible to produce safe, potable, odorless water at very low expense.

ITEMS

NEUTRONS emitted during the splitting of uranium—a process which releases enormous amounts of energy and leads to formation of elements whose atomic weights are fractions of that of uranium—have been traced by investigators of the Carnegie Institution of Washington to the radio-active products of uranium's decomposition, according to an article published in *The Physical Review*. Additional products of the uranium decomposition, which has attracted enormous attention, are also reported in the same issue. According to Dr. Philip Abelson, of the University of California, radio-active antimony, tellurium and iodine have been identified. The four Carnegie scientists who found the source of the neutrons are Drs. R. B. Roberts, L. H. Hafstad, R. C. Meyer and P. Wang.

THE Works Progress Administration in thirty-one months of actual activity has aided educational activities by constructing enough school buildings to put a new one in every one of the 3,000 counties of the United States, according to a summary report of the work relief administration's activities by Administrator Col. F. C. Harrington. Its health activities have included 15,000,000 examinations, immunizations and treatments of medical, dental, nursing and household assistance nature. Seven million visits were made to 1,000,000 families. Other public health activities included extensive drainage operations to eliminate malaria mosquito-breeding areas. Sewage disposal projects, ranging from elementary facilities to disposal plants, have been systematically carried out. Conservation activities have also figured prominently in the program, Col. Harrington pointed out. Erosion control and transplanting projects protecting thousands of acres have been executed. Hundreds of abandoned mines have been sealed to prevent stream pollution.

TEACHING deaf children to talk by use of shorthand, a method devised by Alexander Graham Bell, has at last been vindicated by science. "Entirely feasible," is the verdict pronounced by Dr. Max F. Meyer, of the University of Miami, as a result of experiments on half a dozen children. The method, as proposed by Bell, was first to teach the reading and writing of shorthand words, unabbreviated, then the pronunciation of such words, phonetically written, and only after that the reading and writing of ordinary English. "Fifty years ago, it was," related Dr. Meyer, "when Bell hired a teacher for his small experimental school, but she had not enough patience to continue the experiment for more than one year. In so short a time nothing could be proved. The professional teachers of the deaf ever thereafter scorned Bell's idea, saw nothing good in it. They meted out the same scorn to me when, ten years ago, I began to revive Bell's idea. They even refused to let me announce it in the very *Volta Review* which Bell founded and endowed to spread the teaching of speech to the deaf."

MATHEMATICAL tables highly useful in the theory of relativity calculations are now being computed by the Works Progress Administration for the City of New York. The highly intricate and tedious task is part of the general project on computing mathematical tables sponsored by Dr. Lyman J. Briggs, director of the National Bureau of Standards. In charge of the New York project is Dr. Arnold N. Lowan who, during his graduate studies, worked at the Institute for Advanced Study in Princeton, N. J. Among the projects completed is a table of exponential functions computed to approximately 15 decimal places, and a table of the first ten powers of the integers from 1 to 1,000. The complex tables, worked out by a skilled staff on giant calculation machines, will have inestimable value for mathematicians and other scientists for years to come. Some of the tables have never before been worked out to such exactness.

POTATO beetles are firmly entrenched in Continental Europe, but have not yet succeeded in crossing the narrow seas to Britain. The English Government has placed restrictions on the importation of potatoes and several other vegetables from the Netherlands, which might carry the eggs or pupae of the destructive insects.