SCIENCE NEWS

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DEUTERIUM

DEUTERIUM, or double-weight hydrogen, and the strange things done by the "heavy water" and other compounds containing it, engaged the attention of the country's leading chemists at a special session held at St. Petersburg, Florida, on March 27, as a feature of the annual spring meeting of the American Chemical Society. Participating in the discussion were Professor H. C. Urey and Dr. D. Rittenberg, of Columbia University; Dr. H. G. Brickwedde, of the U. S. Bureau of Standards; Professor H. S. Taylor and Drs. P. W. Selwood, Bryan Topley and Henry Eyring, of Princeton University; Drs. G. H. Dieke and R. W. Blue, of the Johns Hopkins University; Professor Fred Allison, of the Alabama Polytechnic Institute; Drs. L. C. Anderson, J. R. Bates and J. O. Halford, of the University of Michigan; Drs. D. H. Rank and G. H. Fleming, of the Pennsylvania State College, and Drs. Norris F. Hall, T. O. Jones and Everett Bowden, of the University of Wisconsin. The late Dr. E. W. Washburn, of the U. S. Bureau of Standards, pioneer in the study of "heavy water" who died recently, was represented posthumously by his colleague, Dr. E. R. Smith, who presented a report on which they had labored jointly.

Double-weight hydrogen, having achieved a separate name for itself, "deuterium," has now been given a separate chemical symbol, the capital letter D. Hitherto it has been designated by the old hydrogen symbol, H, with the added superscript of a small figure 2, which made of it a symbol which a beginning algebra student might have read "H squared." Its compound with oxygen, popularly called "heavy water," is thus designated D_2O, by analogy with the old familiar chemical symbol for ordinary water, H_2O. Chemists now refer to it not as "heavy water" but as "deuterium oxide." The union of an ordinary, single-weight hydrogen atom and a double-weight or deuterium atom is designated as the molecule HD. Drs. Blue and Dieke reported studies on these compounds, made with hydrogen from the "heavy water factory" recently established at Princeton.

Water is of course the simplest of hydrogen compounds, and "heavy water" correspondingly the simplest of deuterium compounds. But Drs. Rank and Fleming have made a beginning at synthesizing compounds of deuterium with carbon and hydrogen, opening up the series represented in the ordinary chemical world by the natural gas and petroleum compounds. Substituting one atom of deuterium for one of hydrogen in one of the simplest of these, they have produced new compounds which they call "neopentane" and "neopentane deuteride." Similarly, Dr. Rittenberg and Professor Urey have produced, with iodine, "deuterium iodide," or DI, corresponding to the old hydriodic acid, or HI.

HEAVY WATER AT PRINCETON

BY summer from 12 to 15 pounds of the purest heavy water will be available for the Princeton researches. The daily output is now 3 grams ($\frac{1}{10}$ ounce) of heavy water containing 100 per cent. deuterium (heavy hydrogen). The production cost is approximately $5 per gram.

Heavy water produced in Princeton's Frick Chemical Laboratory is the heaviest heavy water so far produced. It has a specific gravity at least two tenths of one per cent. greater than that recorded earlier by Professor G. N. Lewis, of the University of California. The Princeton specific gravity is 1.1078 at 77 degrees Fahrenheit (25 degrees Centigrade) as compared with the California value of 1.1056. The determinations were made by Dr. P. W. Selwood, using in all three ounces of heavy water which failed to increase in density after repeated processes of refinement. For this reason it is believed that pure deuterium oxide has been obtained.

Synthesis of ammonia, wood alcohol and other chemicals will be aided by heavy hydrogen researches carried out at Princeton. It was found that light hydrogen molecules will react with deuterium molecules to produce mixed molecules, with one atom each of light hydrogen and deuterium, at temperatures as low as that of liquid air, using catalysts such as chromium oxide. These results indicate that the high temperatures necessary in industrial syntheses are required, not for the activation of the hydrogen, but for the activation of the molecules with which the hydrogen has to react. If surfaces can be found as active towards these molecules as present available surfaces are with respect to hydrogen, tremendous improvements would be possible in the yields of ammonia and alcohol under much simpler operating conditions. The deuterium experiments indicate the direction which research in technical catalysis must take.

Heavy water will be used shortly in experiments upon the growth of cancer cells as a part of the extensive investigation of the heavy hydrogen twin element being directed by Professor Hugh S. Taylor of Princeton. The cancer experiments will be of "extraordinary interest," Professor Taylor predicted. They will be begun when larger supplies of heavy water are accumulated at Princeton.

PREDICTING TUMOR GROWTH

THE value of grading tumors in order to determine the outcome of cancer was discussed by Drs. Stanley P. Reimann and Clark E. Brown, of the Lankenau Hospital Research Institute, Philadelphia, at the Toronto meeting of the American Association of Pathologists and Bacteriologists.

Because of many variable factors which enter into the situation, this method can not be relied on to determine the outcome in an individual case of cancer, it appeared from the discussion. All malignant tumors, irrespective of grade, should be treated as thoroughly as possible from the moment the diagnosis is made, in the opinion of the Philadelphia physicians.

"By the grading of tumors is meant a prediction of what will happen to a patient when a tumor, usually a

malignant one, is left alone, or is treated,'' Dr. Reimann said. This is done by judging the effect of the environment, which is the patient, on the capacity of the cells of the tumor to multiply and destroy the patient, he explained. Consequently such factors as rate of growth, extent of the tumor and where its deposits are growing, are logical variables in the final equation.

Judgment as to rapidity of growth is made mostly on the degree of maturity of the cells as they appear under a microscope, and their deviation from what is known of the behavior of corresponding normal cells. The more mature the cells in a tumor, the slower is the growth of the tumor. This is in conformity with the well known facts that the cells in very early embryos are more immature than those of older ones, and that very early embryos grow much more rapidly than older ones.

On the basis of these characteristics, tumors can be graded into various classes; for instance, their rapidity of growth and their ability to spread is in direct proportion to disturbances in the ability of their cells to mature and produce a normal part. ''Since, however, the bars of environment offer varying degrees of help or hindrance to the propensities of heredity, and since definite values can not be placed upon all of the variables in this equation, it is impossible to grade tumors for the individual patient. But it can be stated in statistical form, such as: in a thousand patients, those who develop malignant tumors composed of less mature cells will succumb earlier than those whose tumors are composed of more mature cells. When treatment designed to destroy or remove the tumor is applied, such treatment will be more efficacious on the average in those individuals with tumors composed of more mature cells, because, on the average, these tumors will be of less extent and thus more susceptible of eradication.

''On the other hand, even tumors composed of more mature cells may be beyond reach of what destructive agents are used by the time they are applied, and thus those patients also will succumb. It can not always be told at the time the destructive agent is applied whether or not the entire tumor has been reached. Therefore patients can be put into groups, but it is decidedly unsafe to tell any individual patient that because he or she has a tumor composed of mature cells, that he or she will not succumb to its effects.''

VERONAL POISONING

WHY present methods of treating poisoning by sleeping powders are not more effective was explained at the meeting of the American Physiological Society when Dr. Theodore Koppanyi and W. S. Murphy, of the Georgetown University School of Medicine, reported their studies on veronal and related drugs. These modern sleeping powders cause thousands of cases of poisoning throughout the world every year.

Veronal poisoning is treated by injecting into the veins large amounts of sugar and salt solutions with the object of flushing the poison out of the body. Dr. Koppanyi and his associates found that these methods did little good, judging from their effect on dogs. Even with the best method, by which it is possible to drive out as much veronal or barbital in five hours as would ordinarily take two or three days, the improvement is slight.

In other words, methods of treatment directed toward quickly ridding the body of the poison do not necessarily mean the recovery of the patient. Dr. Koppanyi found the reason for this when he studied the action of the sleeping powders on cats and rabbits. With cats the effect of the drug increased each day although more and more of the original dose was being eliminated. These animals were unable to stand, walk or eat and showed depression when the amount of the drug remaining in their bodies was too small to cause any appreciable effect if injected into other cats. With rabbits, on the other hand, the drug was eliminated with increasing slowness so that more and more of it found its way to the blood stream, but when the amount in the body exceeded the average fatal dose, the animals were still able to stand, walk and eat.

Unfortunately, man seems to behave in the same way under the effect of veronal as does the cat. The drug is eliminated from his body in exactly the same way as from the cat's. He therefore suffers from a cumulation of effects of the drug, even after most of it has been eliminated from his body.

THE PROGRESS OF ANTHROPOLOGY

NEW, fundamental light regarding the human body, upsetting old, accepted ideas, was announced recently by Dr. Aleš Hrdlička, of the Smithsonian Institution, in an address before the Anthropological Society of Washington.

Latest researches show that every feature of the body, however tiny, has a range of variation of size, weight, or make-up which is normal. That is, instead of there being a single normal size for a bone or nerve or cell there is a broad avenue of sizes which includes the normal. The very molecules of the body may be found to vary within the limitations of what is normal.

From studies so far made along this line, Dr. Hrdlička has found that the ranges of what is normal are the same for living races all over the world. ''This is deeply significant,'' he explained. ''It shows that living men are all of one species. It shows that our fundamental characters are deeply fixed, not merely recent acquisitions, but older than the modern races.''

This new field of anthropology will require study for many years, even generations, Dr. Hrdlička said. The possibilities have been discovered now because for the first time in anthropological history material in sufficient quantities is available for study. Where, in the past, anthropologists examined a few dozen bones to decide a point, they now study not dozens or hundreds, but thousands.

Another striking and important discovery, made possible by exceptional collections in the Smithsonian Institution, is that every character of man has its own complete and unceasing life history.

''It has always been considered that human characteristics become fixed and finished when adulthood is reached,'' Dr. Hrdlička stated. ''In these new collections we have sufficient juvenile material of all stages of

growth and also fairly sufficient material showing different ages of the adult, into senility. All of this is now showing that every feature—teeth, hair, bones—changes without cessation from the beginning of life, before birth, to the oldest age. Every feature has its definite life curve or life cycle. The change may be slower and less marked in some features than in others, but it never ceases.''

Anthropology as a distinct branch of science is just about a hundred years old, Dr. Hrdlička stated, in commenting on the astonishing amount of work that has been accomplished in a century toward the understanding of man. Among the important problems that remain for future solution, he outlined the following: further knowledge of fossil anthropoid apes, of human precursors of man, of man of the earlier stages; definite tracing of the origin of *Homo sapiens;* establishing more precisely the mental differences of racial and other human groups, and learning how these differences and environment affect their human culture, behavior and language.

ITEMS

INVESTIGATORS at Princeton have searched carefully for the new triple weight hydrogen (tritium) which Lord Rutherford a few days ago announced had probably been synthetically produced by bombardment experiments with deutons or the hearts of double weight hydrogen. But they are sure that hydrogen of mass 3 does not occur in ordinary water more plentifully than one part in 500,000,000. The mass spectrograph researches of Dr. Walker Bleakney and A. J. Gould also show that in the purest heavy water thus far obtained the concentration of this third hydrogen is less than one part in 50,000. Double weight hydrogen or deuterium occurs one part in 5,000 in common hydrogen here on earth.

EUROPIUM, one of the rarest of the chemical elements, weighs more than the books say it does. It has had its weight re-determined by two University of Illinois chemists, E. L. Meyers and Professor B. S. Hopkins, who reported their results at the meeting of the American Chemical Society. Because of its extreme rarity and also because it has no present known commerical use, the element has been but little studied. The re-determination by the two chemists raises the figure for its atomic weight from an even 152 to 152.3. This is something over double the atomic weight of copper, which is 63.57, but materially less than the atomic weight of gold, 197.2, and lead, 207.2.

CYCLOPROPANE, a gaseous anesthetic which is becoming popular in some hospitals because its use is not followed by nausea and also because it is relatively safe from explosion, has been prepared cheaply from certain constituents of natural gas, by three Purdue University chemists, Dr. H. B. Hass, E. T. McBee and G. E. Hinds. At the meeting of the American Chemical Society, they reported on the process by which they have lowered its cost to a fraction of what it used to be.

How the fumes of carbon tetrachloride, familiar as a cleansing agent, hookworm remedy and fire extinguisher, affect the digestion, liver and blood was reported by Dr. George M. Higgins, of the Mayo Foundation, Rochester, Minnesota, at the meeting in Philadelphia of the American Association of Anatomists. Dr. Higgins worked with white rats, letting them breathe known concentrations of the chemical for one hour daily. He watched their growth, weight and the amount of food they consumed during this period. Test meals remained in the stomach 62 hours longer than normal. Frequent hemorrhages and inflammation of the digestive tract were observed. After a single hour's inhalation of the carbon tetrachloride changes appeared in the liver. After 30 hours of inhalation cirrhosis involved the entire liver. Changes also occurred in the number of red and white blood cells and the amount of hemoglobin, anemia gradually appearing.

EVEN the ignominious plant parasite is fearsomely endowed with an ''instinct'' which increases its chances of success in life, according to Dr. Thorvaldur Johnson, pathologist in the Dominion Rust Research Laboratory at Winnipeg. In a report in *Phytopathology*, he shows how a germinating wheat-rust spore crosses a wheat leaf in such a way as to give it the best chance to infect the plant. The germ tube of the germinating rust ''seed'' crosses the wheat leaf at right angles to the veins. By that procedure the fungus has the maximum chance of arriving at a stoma or ''breathing pore,'' the usual place for infection to take place, in the shortest possible time.

SUCH drugs as veronal and amytal when given to relieve the pain of childbirth may pass from the mother to the baby and poison the latter. Evidence of this was presented by James M. Dille, of Georgetown University School of Medicine, at the meeting of the American Physiological Society. Obstetricians observing the condition of babies whose mothers had been given these drugs have reported conflicting views. Some found the babies were normal, others found the babies showed they had been poisoned by the drug. The question appears to have been settled by the investigations Mr. Dille made on animals. Using a very exact method of determining the presence of these drugs, Mr. Dille was able to detect relatively large amounts of amytal or veronal or barbital in the unborn offspring of guinea-pigs, rabbits and cats which had received doses of the pain-relieving drugs or sleeping powders. In some of the offspring he found almost enough of the drug to produce anesthesia.

THE rate of increase in population during 1933 for the United States was less than half what it was in Japan, it is announced by the Scripps Foundation for Research in Population Problems. The United States added 6 new souls for each thousand of her population while Japan added 14 per thousand. The actual gain in numbers was also greater for Japan, amounting to 942,600 during the year, while the increase in the United States was only 797,000. Yet the total population of the United States is estimated to be 126,144,000 on January 1, 1934, as against Japan's 67,470,000.