SCIENCE NEWS

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PAPERS PRESENTED IN PHILADELPHIA AT THE MEETINGS OF THE AMERICAN PHILOSOPHICAL SOCIETY

THE existence of a new "scale" for weighing individual atoms that occur by the billions in a single speck of matter was described by Professor A. J. Dempster, of the University of Chicago. Dr. Dempster's atom "scale" is known to science as the mass spectrograph. Although the device itself weighs several tons, it can determine the weight of the individual atoms of the chemical elements which compose everything in the world. It is used in detecting isotopes of the various kinds of matter, the varieties of a substance like chlorine or oxygen, which are chemically indistinguishable but have slightly different weights. Secret of the delicacy of the apparatus is a system of "electric lenses" which accurately focus the electrically charged atoms of the element under study as they pass through the device. These ions have to pass through a narrow slit only one thousandth of an inch wide as they enter the "scale." After curving under the action of a magnetic field, the ions strike a photographic film and register their position. Different weight ions fall at critically characteristic positions on the film. The measurements which establish their relative weights are based on a highly accurate determination of the position of the lines. The ideal situation would be to have the lines sharp and clear, but in past instruments the lines were always wider than the entrance slit used because the ion beam was gradually spreading out like the rays from a searchlight. The "electric lenses" in the new instrument focus the various beams of different weight ions into extremely sharp lines on the film after first letting them spread out into their magnetic "weight" pattern. Using a new source of ions in conjunction with the instrument, Dr. Dempster has "weighed," for the first time in the history of science, the isotopes of gold and platinum in the pure state. The new source of ions is a highly intense electric spark which knocks out atoms from the element being studied and at the same time strips an electron from many of them, and hence gives them the needed electric charge.

THE first definite proof that there exists a super-heavy chemical element beyond the confines of the 92 chemical elements has been obtained by Dr. Aristid V. Grosse, of the University of Chicago. Dr. Grosse described before the meeting of the American Philosophical Society the production technique by which the rarest of all metals—protactinium, element No. 91, is now being obtained in pure form. In an interview with Science Service Dr. Grosse pointed out that Professor Enrico Fermi, of Italy, has revived his earlier tests for proving the existence of element No. 93 and substantiated his claims. Dr. Grosse had previously contended that the Italian investigator was really working, unknowingly, with protactinium already isolated. Because of this new test and the further substantiation of the epoch-making feat by Drs. O. Hahn and L. Meitner in the Kaiser Wilhelm Institute in Berlin, Dr. Grosse stated that he had withdrawn his past objections. Theoretically the way seems clear for the creation of a whole series of artificially-made chemical elements previously unknown. The super-heavy elements are created by bombarding the heaviest naturally-occurring element, uranium, with neutrons. The neutrons pierce the cores of the uranium, stick there and thus increase the weights of the atoms. Although neither elements 93 nor 94 have been isolated in pure form, Dr. Grosse, from a study of the chemical properties of the known atoms, predicts that they will have characteristics associated with the two rare metals, rhenium and osmium. This means they will be extremely hard and heavy metals. Rhenium has only recently been applied to industry with the discovery of how to electroplate it on to other metals. Highly resistant to sulphuric acid, rhenium is expected to find wide use in lining tank cars and other containers for shipping this acid, which formerly was transported in glass bottles. Protactinium, which Dr. Grosse described in his report to the society, is rarer than radium. It is obtained from five tons of residue ore from the radium factory at Joachimstahl, Czechoslovakia, being worked over in laboratories at Chicago. From two tons of this ore one half milligram of pure protactinium has been obtained. So far the concentration necessary, Dr. Grosse said, was equivalent to saving only one part out of four million of the original material. Like radium, protactinium gives off alpha, beta and gamma rays, but the possible therapeutic value of the rays is yet untested. Only recently has a sufficient quantity been available to allow its distribution to medical laboratories. The alpha rays or nuclei of helium atoms which protactinium shoots off in disintegrating have energies equal to 2,540,000 electron volts—higher than those of radium. And it is much more lasting than radium, for its life period is 46,000 years where radium is only 2,500 years.

THE search for more exact determinations of the weights of atoms is meaningless in many cases at the present time, according to Professor Harold C. Urey, of Columbia University. The striking statement was made in a discussion of the ways science can separate the chemically indistinguishable isotopes of many elements such as hydrogen, oxygen and chlorine. Hydrogen and oxygen are found in common water, oxygen in air man breathes and chlorine in common table salt. What a scientist finds for the atomic weight of an element depends on how his sample of the element was prepared. If gaseous carbon dioxide is trapped in a vessel inverted over a pan of water the oxygen in the gas differs in atomic weight from the oxygen in the water by about one part in one hundred thousand. Thus the standard of atomic weight certainly can not be regarded as constant within this limit. "Atomic weights given to more significant figures will be meaningless unless the isotopic composition is specified," Dr. Urey said. "Many of the methods of determination of the isotopic composition apparently would give false results because

of fractionation in the processes involved. If these difficulties were overcome, and the exact value for the atomic weight of a given sample of an element were secured, it could not be used with certainty for some other sample unless its isotopic composition were known. Thus we must conclude that the atomic weights of many common elements, as determined by known chemical methods, are not fundamental constants of nature to more than a limited precision. This limit of precision has been reached in the case of lithium, oxygen, chlorine and, perhaps, other elements.'' A new method for separating the ''chemical twin'' isotopes of some of the lighter elements like oxygen and carbon is now being tried out at Columbia University. Known as a ''countercurrent scrubbing apparatus'' the device gives promise of greatly increasing the concentration. Theoretically the system yields an increased efficiency of some 800 times over methods now used. Describing the system for oxygen, Dr. Urey outlined how at the top of the apparatus carbon dioxide can be mixed with hydrogen to yield water and the gas methane. The water thus formed runs down the apparatus and at the bottom is separated into hydrogen and oxygen electrochemically. The oxygen is then combined with carbon to form carbon dioxide and passes back up the apparatus to repeat the cycle. Gradually the isotopes of oxygen are separately concentrated by this ''scrubbing'' technique.

DR. CHARLES B. DAVENPORT, of the Carnegie Institution of Washington, outlined a hypothesis of genic control over developing cells. Genes, he said, are believed to act as chemical catalysts to speed up the life processes, or metabolism. For the multifarious activities of each cell, guidance of hundreds, even thousands, of genes is necessary. Every time a cell divides there must be a corresponding division of genes, with a full set going to the new-formed cell. To insure this, a set of guiding threads of living stuff exists, called the chromonemata. ''The genes,'' Dr. Davenport continued, ''during the metabolic stage of the nucleus, lie usually in the nuclear membrane where the cytoplasmic molecules are attracted to them by differences in electrical charge and union with other molecules is expedited. In the adult body the nuclear genes continue their activity in connection with the manufacture of cell enzymes and other cell products.''

A DRAMATIC glimpse at an entirely different angle of the reproductive process was given by Dr. Albert F. Blakeslee, also of the Carnegie Institution of Washington. It had to do with the terrific prodigality of organisms in producing microscopic bits of themselves that can be scattered abroad, so that they may ''be fruitful, and multiply, and replenish the earth.'' In the course of his work for many years, Dr. Blakeslee said, he has had much to do with the productive processes of common fungi, especially the all-too-common mold on bread. To many persons this food-spoiling fungus seems to come from nowhere, almost to generate itself out of thin air. But it really grows from spores, one-celled microscopic reproductive bodies that function like seeds but are incalculably more numerous. As a demonstration of spore numbers, Dr. Blakeslee used a different kind of fungus, a giant puffball found in a garden. It was a little over a foot long, ten inches wide and nine inches high. It consisted almost entirely of a mass of spores. He took one tenth of a gram of the spores—a little less than enough to fill a two-grain quinine capsule. These he mixed with water, to thin them out, and counted the spores in sample drops of measured size, under a microscope. The result of his calculations ran the spore number in this one giant puffball up to about six trillions. That would be enough, said Dr. Blakeslee, to put one spore into a sixteen-foot square on such a giant checkerboard covering the land surfaces of the whole earth. If they were confined to the United States, there would be a spore to every fifteen square feet. Theoretically, every one of these spores is capable of giving rise to a new plant of its own kind. Actually, nearly all of them fall into unsuitable places, and so perish. But considering the vast number of fungi of all sorts constantly casting their spores into the air, it is not remarkable that they turn up, apparently by magic, every time we give them any kind of a chance.

OLD women, sitting quietly in the sunset of their days, have given science an idea of how much energy is required just to be alive. Dr. F. G. Benedict, of the Carnegie Institution of Washington, told his hearers of what he had learned from his measurements of the metabolism, or basic life-rate, of 36 women between the ages of 66 and 86. They were, most of them, neither fat nor lean, neither energetic ''flapper grandmas'' nor ''poorly in health.'' They were just middle-aged to old average American women. Things that speed life up for most of us had ceased for them: hard work was at an end, romance and other strong emotional stimuli were things of the past. They were just quietly and calmly alive, and that was all. For such women, specifically for those over 78 years old, an average of 1,023 calories of food-energy a day was enough, Dr. Benedict found. This is only about half as much food energy as is needed by younger women in their more active years of work, marriage and child-rearing. The caloric requirements of such women are stated variously as from 1,800 to 2,500 a day, depending on age and nature of activities. Men's requirements are even higher: from 2,200 calories a day at light work to 6,000 at work requiring extreme muscular exertion. Thus, the village blacksmith may be nearly six times as active a living machine as his aged grandmother, and even the village clerk will have double her body-fuel necessities. A calorie is basically a heat-unit. A thick slice of bread, or a lamb chop, or a dozen shelled almonds, or four small pieces of bacon, will each yield 100 calories of energy.

HEREDITY is not necessarily a fixed, unalterable, predestined pattern of events for human beings. Environmental factors, which modify hereditary behavior patterns in an individual's separate life time, may also even change the nature of the genes themselves and thus alter the course of all future heredity of the line. This, in essence, was the thesis advanced by Dr. Aleš Hrdlička, of the U. S. National Museum. Genes were defined by Dr. Hrdlička as ''the molecular embodiments of heredity.'' Being basically chemical, they are amenable to

chemical forces, and these may be brought to bear on them by the environment. "The extraneous influences may act as stimulants, fostering the emergence or glow of heredity; as depressors or inhibitors of the same; or as damaging or destroying agencies—gene-poisons," said Dr. Hrdlička. "In general there is a mixture of these factors and the results depend on their relative strength, and on their reactions with the hereditary endowments and manifestations."

AT the same session, Professor G. H. Parker, of Harvard University, told of the influence on the bodies of animals exerted by chemical substances—"neurohumors"—produced by the nerves. When a certain bundle of nerve-fibers in the tail of a fish is severed, a dark band appears, and then very gradually goes away again. The manner of its appearing and vanishing has suggested to observers that it is due to neurohumoral action. In the experiments reported the evidence was strengthened by a series of photographs taken every hour of the same region in the same fish.

PEOPLE need not worry that man will become merely a machine because of the march of science in civilization, according to Professor E. L. Thorndike, of Columbia University. There is no need for a concern of those people who think the applications of science will make man into a mere automaton and abolish free will. Speaking on the "paradox of science," Professor Thorndike explained how mankind should, for centuries to come, escape from what now seems to some to be a dilemma. Man may be part of the "machine" known as civilization, he said, but the "machine" differs greatly from machine used in the ordinary sense. The saving factor is that the parts of the social "machine"—the people themselves—can change the workings of the machine and even its construction. Science seeks to learn the workings of the immutable forces of nature and the more widely and exactly these workings are known the more man can do with them. It is the very repeatability of natural laws which enables man to adapt them into his scheme of things or adapt himself and his social "machine" to them.

DUST storms now sweeping the West should afford science one means of finding out more about the atmosphere surrounding Venus, "veiled-planet," according to a suggestion which Dr. V. M. Slipher, director of Lowell Observatory, Flagstaff, Arizona, will make to the U. S. Weather Bureau. His plan for utilizing earth's dust storms for science would be to make airplane flights high above the dust clouds and measure the upward reflection and scattering of sunlight on the dust layers. Such information should be of value when applied to the planet Venus, which appears to have perpetual dust storms in its atmosphere. Venus is without moisture to lay such dust, which once stirred up floats continually high above the surface of the planet. That at least is the present hypothesis which Dr. Slipher would like to check with airplane dust-cloud measurements on earth. Recent observations show that the weather prediction for Mars now is "cloudy and warmer." Mars is going through what is summer for its northern hemisphere and such times are accompanied by an increase in cloudiness. Similar measurements made in 1920 showed comparable cloudiness.

SUPERSTRATOSPHERE winds blow at 200 miles an hour. A fiery visitor from outer space, flashing into earth's upper atmosphere, that made possible the measurements of these winds at the high levels where transoceanic planes should some day fly was reported by Charles P. Olivier. A giant fireball flared through the sky over Texas and Oklahoma in 1933, striking terror into the hearts of superstitious persons. More cool-headed and scientific-minded individuals took measurements and Dr. Olivier has been busy with calculations based on them ever since. As the fireball tore overhead, 18 miles up, its long train of smoke was left behind and gradually broke into knots or clouds. The rate at which these left-behind clouds moved is a measure of the superstratospheric winds. They averaged 200 miles an hour.

ITEMS

VITAMIN B4 apparently can prevent anemia by stimulating formation of red blood cells, according to Drs. Jean L. Kyer and Frank H. Bethel, of the Simpson Memorial Institute, Ann Arbor, Mich. The anemia in this case is not pernicious anemia but the kind known as nutritional anemia. Other parts of the vitamin B complex, which is made up of at least four vitamins, were not effective in preventing anemia, experiments with rats showed. Vitamin B4 may play its important antianemic rôle by influencing the production of hemoglobin, the coloring matter of blood.

THE body's defensive forces for resisting invasion by disease organisms can be artificially stimulated by vaccines or similar preparations only up to a certain point. Experiments showing that there is such a limit to the body's capacity for acquiring resistance to disease were reported by Drs. Reuben L. Kahn and Elizabeth B. McDermott, of the University of Michigan, at the meeting of the American Society for Experimental Pathology. Up to a certain point the capacity of the body to resist invading disease germs may be increased by increasing the number of doses of immunizing serum or vaccine. After that point has been reached, further immunizing doses produce very little response from the body's defensive forces.

SPECIMENS of a tiny crab—only a quarter of an inch across—that forces growing coral animals to build a house for it have been brought back to the Smithsonian Institution by Dr. Waldo L. Schmitt, who has recently returned from an expedition along the northwestern coast of South America and to the Galapagos Islands. The gall-crab, as it is called, was known in the western Pacific, but had not been found east of the Hawaiian Islands. When very young, the crab attaches itself to the end of a coral branch, just as it is starting to branch again. The presence of the crab probably acts as an irritation to the coral, increasing its rate of growth. At the same time currents are set up in the water which determine the direction of this growth. The result is that the two branches fold over and come together, completely surrounding the crab in a limestone cell. There are tiny airholes by which it is able to remain alive.