SCIENCE NEWS

Science Service, Washington, D. C.

SOME PAPERS READ AT THE ATLANTIC CITY MEETING OF THE AMERICAN ASSOCIATION AND ASSOCIATED SOCIETIES

A NEW theory of atomic structure that may allow physicists to understand better the composition of matter was presented to the American Association for the Advancement of Science by Professor George D. Birkhoff, of Harvard. It is called "a conceptual theory of atomic structure" and may recall to modern approval fundamental ideas that were first presented by James Clerk Maxwell. At the Philadelphia meeting of the association in 1926 Professor Birkhoff presented a paper showing how the fundamental wave equation, which had been discovered by Schrödinger within a few months, could be arrived at in an entirely different manner. This was done on the basis of a conceptual theory of matter and electricity. This paper won the $1,000 prize for the 1926 meeting. The principal characteristics of this theory were the following. A relativistic space-time was employed as the background for a certain "perfect fluid" which was the carrier of positive or negative electricity. In this fluid the disturbance velocity was that of light. The fluid was further endowed with a certain "atomic potential" which gave rise to a new term in the energy tensor of the fluid. In addition the positively and negatively charged portions of the fluid could freely interpenetrate. It was then shown that with suitable simple choices of the disposable quantities the same spectral frequencies would be obtained for the hydrogen atom as arise from the Schrödinger wave equation when use is made of the Planck-Einstein law. However, in the further development of the theory considerable difficulties arose and it has only been recently that Professor Birkhoff has studied the mechanism of radiation. Very significantly it has turned out that the arbitrary introduction of the Planck-Einstein law can be dispensed with. Whether or not his modified theory proves to be ultimately serviceable to physicists as an actual atomic model, it presents suggestive points of interest which it is hoped will stimulate further studies of the same kind. Such studies ought to be made since the possibility of conceptual relativistic models has not been thoroughly explored. If an acceptable model could be found which corresponded to reality, physicists would be forced to revert to the concept of the atom as bearing the stamp of the "manufactured article," in the sense of James Clerk Maxwell.

DR. HARLAN T. STETSON, of the Massachusetts Institute of Technology, suggested to the section on astronomy of the American Association for the Advancement of Science that the sun and moon may both be responsible agents for causing the apparent distance between New York and London to vary during the day and year. Dr. Stetson, on eliminating the effect of the moon by averaging intervals of observation from new moon to new moon, has been able to show that there results a curve of an annual variation in longitude with a maximum about January 1, when the earth is nearest the sun, and a minimum about July 1, when the earth is farthest away from the sun, actually some four million miles farther distant. From three years' observations (1929–1931), it appears that London on the average was 39 feet farther from Washington on New Year's than on the Fourth of July. This is about two thirds the value (63 feet) which was attributed to the effect of the moon four years ago. Just how much of the 63 feet then supposed due to the moon may be indirectly laid to the sun, Dr. Stetson would not say until further investigations make possible a more complete separation of the effects of the principal disturbing sources. There is as yet no adequate explanation of the phenomenon. Since the greatest distance in general has occurred in winter, it is obvious that the effect is not due to a direct heating of the northern hemisphere or its atmosphere.

A NEW method that can record the slightest change in the gases that go in and out of a plant, measuring differences as small as one part in a million, was described by its inventor, Dr. E. D. McAlister, plant physiologist at the Smithsonian Institution, Washington, D. C. It depends on the use of the invisible infra-red rays, measuring them after they have passed through the carbon dioxide, water vapor or other gases under study, and keeping a continuous record of all fluctuations. The amount of radiation of certain wave-lengths thus absorbed is an indication of the abundance of the gas that is absorbing it. Carbon dioxide absorbs one group of wave-lengths, water vapor another, and so on. The new method is the first ever used that can keep such a continuous record, and it can be used on the breath of animals as well as the gaseous exchanges of plants. Possible uses of the new method are manifold. For instance, it has never before been possible to tell what happens in a green plant that has been in darkness, during the first few seconds after the light has been turned on. Also, it has been proved for the first time that light shining on a plant does not make it use up its foodstuffs any faster than it does in darkness. One curious phenomenon in plants, discovered by the new method, may eventually have considerable practical importance. It has been found that turning the light on and off, on and off again, at short intervals, produces a rate of carbon dioxide use in making food quite different from the rate that obtains under usual conditions of continuous sunlight.

RESEARCHERS into the brain from the standpoint of behavior held a symposium under the leadership of Dr. Leonard Carmichael, of the University of Rochester, a pioneer in the study of brain waves. The electrical impulses from the brain, which may be tapped and recorded as wavy lines, can be thought of as broadcasts from the brain, capable of giving real information as to what is happening there. The old picture of the brain as a telephone exchange, through which the sense organs "dial"

the muscles and give them orders, is still true in a limited sense. But the brain has inner forces newly discovered. It has its own "inter-office" communicating system which joins the cerebral cortex, generally thought of as the thinking and directing part of the brain, with the thalamus, which has responsibility for those unthinking "automatic" functions such as digestion, emotion, perspiration, temperature regulation, heart beat and breathing. Just as a business executive keeps in constant communication with his office manager, so a continuous mutual exchange of messages goes on between these two parts of the brain. And this is independent of the flow of signals coming in from the outside and going to the acting parts of the body. Man's brain takes on new dignity. It is no passive mechanism set in motion by stimulating forces from the outside and lapsing into inaction again when these forces cease to bombard the senses. The brain is now viewed as a reservoir of stored energy which is released rather than created by the messages sent by the sense organs.

FIVE out of each hundred unemployed persons can never get jobs because they are totally unfit psychologically for work. Another eighty-five will be fit for employment only after long periods of training and possibly psychiatric treatment. Only ten are now actually fit for placement in industry should jobs be found for them. This scientific assay of the human resources in America's great group of unemployed was presented to the association by D. R. Shearer, who based his figures on the study of unemployed at the psychological clinic of the Tennessee Eastern Electric Company, Johnson City, Tenn. The unemployed group was drawn from the population of a town of about 30,000 persons in which more than ten per cent. are out of work. Statistical techniques were used to adjust the figures obtained in an effort to make them more truly representative of the total unemployed population. No precision was claimed for his figures by Mr. Shearer. He presented them because they give a rough idea of the unemployment problem as it is seen from the scientific, rather than the emotional or armchair theorist's angle. The urgency of a further pushing of this scientific approach was urged. The large group which consists of those who are now unemployable but may be developed to a point where they can be absorbed into industry and into various lines of work, is that needing the particular attention of personnel students, educators and psychologists. This is the crux of the unemployment problem and a satisfactory method of handling this group can be reached only by the cooperation of all the social, civic and governmental agencies in setting up a regime for developing those unfortunate persons.

MANKIND joining in a great mass movement toward self-destruction, driven blindly into a war by stern biological forces that they do not understand. That was the mental picture presented by Dr. Raymond Pearl, of the Johns Hopkins University. Studying the fruit fly, beetle and the yeast cell, among whom hundreds of generations can be observed by a single living scientist, Dr. Pearl has drawn lessons that apply to higher forms of life, including man himself. The lemming, a lower mammal, demonstrates how blind biological forces drive creatures to multiply until great population pressures are built up and then drive them on to mass suicide. This Arctic animal has great spurts of reproductivity and, after the density has reached a certain limit, starts mass migratory movements. These great marches blindly push on until some obstacle like the sea or a river is reached. There vast hordes of the migrants still push on to their death. A parallel is found in the rapid growth of human population. In a minimum of 100,000 years up to the year 1630, man's numbers grew only to 445,000,000. Yet in the 300 years since then, the population has grown to some 2,073,000,000. For thousands upon thousands of years the human population of the earth grew slowly, because the conditions necessary to more rapid growth did not exist. Then about 300 years ago, the advancement of learning suddenly expanded man's effective universe and has kept on expanding it. There has followed a spurt of population growth of an explosiveness that is seen, when plotted to a proper time scale, to be comparable to that of an epedemic. This has produced a density of forty persons per square mile for every single square mile of the land area of the earth. That there are associated with this present density stimuli producing sensations of discomfort seem scarcely open to argument. Can it be honestly denied that, on a world-wide view, unrest is the dominant characteristic of human behavior to-day? And behavioristically viewed, unrest is surely the cardinal symptom of discomfort. Up to this point the parallelism in between the two cases seems reasonably evident. One scarcely envisages mankind marching to a watery grave just behind a horde of frantic lemmings. But does any one find it difficult to conceive of man marching off in the not too distant future to a war? Or to doubt that once well started that war will entangle in its meshes the major portion before it is finished?

NEW evidence for striking likeness in physical and chemical make-up between viruses, the submicroscopic "living molecules" that transmit diseases, and genes, the invisible somethings that abide in or on the chromosomes of cells and transmit hereditary qualities in humans, animals and plants, was produced for the consideration of biologists by Drs. J. G. Gowen and W. C. Price, of the Rockefeller Institute for Medical Research, Princeton, N. J. Drs. Gowen and Price traced this vital similarity between viruses and genes through ultra-violet and x-ray experiments on the particular virus that causes the mosaic disease of tobacco leaves. First, they took juice pressed out of the diseased leaves, known to contain the virus, and rayed that, keeping track of the rate at which the virus was killed off. But they knew that the juice contained plenty of non-virus protein molecules, that absorb the rays; it was as though they were firing at targets that were scattered among sandbags. So they purified the virus, getting it in crystalline form, and bombarded that with rays. The rate of destruction was greatly increased. Then they mixed more of the purified crystalline virus in juice pressed from undiseased leaves, and rayed the mixture. The rate of destruction of the virus became almost identical with that in the original juice from dis-

eased leaves. Raying the virus with non-lethal doses of either ultra-violet or x-rays produces "mutations," just as raying the germ-cells of animals and plants brings forth these sudden evolutionary shifts. These mutations in the virus show themselves in the changed character of the injury they do to leaves when they are injected into the plants. In general, viruses and genes are "hit" by various kinds of rays in a rather similar fashion, and respond in ways that are suggestively alike. The inference therefore seems legitimate that in size at least, and quite possibly in other ways as well, they really are alike.

A NEW tool for use in the study of viruses was described by Dr. Ralph W. G. Wyckoff, of the Rockefeller Institute for Medical Research. It is an air-driven ultracentrifuge which whirls viruses around as milk is whirled in a cream separator, only at such high speeds that the infinitesimal virus molecules settle out. The force required for this is from tens to hundreds of thousands of times that of gravity. Dr. Wyckoff's ultracentrifuge is simple by comparison with a previous model, built in 1912 by another scientist, which was so costly to build and operate that until last year no duplicates had been made. The Wyckoff model should not cost more than three or four hundred dollars to duplicate. With the aid of this new machine investigators have the basis for a method of preparing pure virus without having recourse to chemical treatment. This opens up the way to the study of viruses which are relatively unstable or present only in small amounts. The machine can also aid in measuring the size of virus particles, in telling whether a preparation is pure and what may be the molecular weight of its impurities, and in determining whether a virus consists of one molecular species or a family of related compounds.

STUDIES of antigens undertaken in the hope of finding more effective ways of using them to protect against disease were reported by Dr. Stuart Mudd, of the University of Pennsylvania School of Medicine. The use of bacterial vaccines to protect against disease and to produce curative serums has often been limited by the toxicity of the vaccines used. If the pure substances required for immunization could be obtained free from the other toxic substances, the problem would be greatly simplified. On the other hand, the chemical methods used to obtain immunizing bacterial substances have been too drastic and have often destroyed the value of the very substances it was desired to use. Dr. Mudd described three new physical methods of disintegrating bacteria without destroying their immunizing substances. With one of these methods, Dr. Mudd and associates, Drs. E. J. Czarnetzky and Horace Pettit and Mr. David Lackman, obtained and purified the delicate immunizing substances of hemolytic streptococci. The surface immunizing substance obtained from these germs can be broken down into two fragments. One of them has been used to distinguish streptococci which cause human disease from those causing animal diseases. The other has been used to classify the human streptococci into types. The delicacy of the immunizing substances is due to the fact that they can be readily oxidized.

FUNDAMENTAL knowledge of cancer which probably is paving the way for discovery of a chemical means of controlling the disease was reported by Drs. Carl Voegtlin, J. M. Johnson, M. E. Maver and J. W. Thompson, of the National Institute of Health of the U. S. Public Health Service. Research by Dr. Voegtlin and associates has shown that, so far as the need for protein nourishment is concerned, cancer cells are just like normal cells. Cancer growth can be stunted the same as normal growth by withholding certain chemicals, the amino acids, which are the building stones for protein tissues and without which no tissue, normal or malignant, can grow. The studies reported show that the cancer cells need the same kind of materials for growth as normal cells but it is not yet known whether cancers need these materials in the same quantities that normal cells do. That now appears to be the crux of the problem. The question of distribution of chemicals throughout the body must also be considered in searching for a chemical cure for cancer. There is no reason why some chemical can not be found which would be taken up by malignant cells more than by normal cells. However, progress in understanding the chemical mechanisms which regulate the proliferation of malignant tissues depends on further progress in the study of the proliferation of normal tissues.

NORMAL, healthy tissue of the body itself may yield an effective weapon against cancer. This possibility appears from experiments reported by Dr. James B. Murphy, of the Rockefeller Institute for Medical Research, at the cancer symposium. Dr. Murphy has extracted from various kinds of body tissues a substance which checks the growth of cancers and another substance which stimulates their growth. The work is still in the laboratory stage and has not yet progressed to the development of anything like a practical means of curing cancer. But Dr. Murphy says that "The results are definite and leave no doubt that normal tissue may yield a substance apparently harmless to normal cells which prevents or retards the growth of cancer cells." From extracts of fowl tumors a substance was obtained which, when concentrated, neutralized the filterable causative agent of the tumor and prevented the growth of a type of cancer in other animals besides fowl. A similar cancer-growth-checking substance was found in several active normal tissues. Chief among these tissues are placenta, embryo, skin and prelactating mammary gland. Material from these tissues definitely checked the growth of transplanted cancers in laboratory animals and also checked the growth of new cancers that occurred naturally or spontaneously in such animals. In the case of one tissue, the prelactating mammary gland, it has been possible to separate out both an inhibiting and a stimulating factor for transplanted cancer. Dr. Murphy's studies were undertaken on the theory that cancer is the result of a break in the supposed balancing mechanism of the cell which consists of a stimulating and retarding factor. The evidence obtained from his studies can not be considered adequate support for the general hypothesis that malignancy is a break in the internal control mechanism of the cell.

A NEW theory of cancer which promises to upset many current theories was presented by Dr. Felix Bernstein, of

New York University. The question of which persons cancer will claim for its victims seems, according to Dr. Bernstein's theory, to depend on much the same sort of factors that determine which persons will develop hay fever or other allergic diseases. As in hay fever some persons have an inherited tendency to become susceptible or hypersensitive to such factors as pollens or dust, so in cancer, Dr. Bernstein suggests, some persons have a hereditary tendency to become hypersensitive to external irritation. Hay fever, even in those who inherit the tendency to it, does not usually develop until several years after birth. Physicians believe its development depends on the extent of exposure to the irritating pollen or dust. In cancer Dr. Bernstein says the interval before the malignant condition develops in those inheriting a susceptibility to it is determined by genetic factors—factors present in the body's make-up at birth. During this interval the body is acquiring its special sensitivity to the irritating factors that lead to the development of cancer. Cancer may be a hereditary allergic disease with a genetically determined time interval of acquired hypersensitiveness to external irritation.

IN another decade the words used in teaching science in elementary and high schools will be more extensive and richer than the simple vocabularies that have become pedagogically fashionable during the past few years, Dr. Otis W. Caldwell, general secretary of the American Association for the Advancement of Science and long a leader in science education, predicted to the American Science Teachers Association. Science text-books of twenty or thirty years ago were prepared by scientific experts who did not realize the need of non-technical language in science teaching. As a result, educational experts studied the words used by children of various ages and science material for school use was written in the common and meager vocabulary of people who are not far ahead of mere literacy. Now it is necessary to rise from this low level and give the best students and teachers vocabularies which shall grow as rapidly as their new thoughts and experiences. Science instruction that will be coherent and cumulative throughout the pupil's whole school training from first grade through high school will be achieved in the next decade. And teachers will be well trained in knowledge of the science they teach as well as in education methods upon which most emphasis has been laid in recent years.

THE guilt of causing the sudden and remarkable radio fade-outs discovered in 1935 by Dr. J. H. Dellinger, National Bureau of Standards radio chief, was fastened upon bright eruptions of the sun by research reported by Dr. R. S. Richardson, of the Mt. Wilson Observatory of the Carnegie Institution. In the past two years eighteen fade-outs of high-frequency radio transmission affecting the daylight side of the earth for a few minutes have coincided closely with bright solar eruptions observed near sunspots. But some eruptions are not followed by the fade-outs and Dr. Richardson therefore suggests that the condition of the earth's upper atmosphere, as well as the radiant energy of the sunspot, may be a factor in determining the occurrence of a fade-out.

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