SCIENCE NEWS

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SOME PAPERS READ AT THE PITTSBURGH MEETING OF THE AMERICAN ASSOCIATION

LIKE a careful contractor who removes a stone of doubtful strength from the foundations of a building, Professor Albert Einstein strengthened the basic foundations of his theory of special relativity in his address before a select group of four hundred and fifty mathematicians and physicists, taking his audience back to 1905. That was when his paper on the special theory of relativity appeared. At that time, he explained, it seemed necessary to use the concept that an electromagnetic field energy may be localized. Electromagnetic field may sound complicated, but it is the varying electromagnetic waves sent out by a broadcasting station which makes the radio sets in the homes of America operate. The concept that the energy in a magnetic field might be localized in various points in space, Professor Einstein said, has always been debatable among scientific men. One group felt that the idea was sound, the other believed it was not—but neither could prove its point. It is this unprovable doubtfulness which Professor Einstein feels is a weak link in his 1905 paper on relativity. In his address Professor Einstein gave a simple proof of the way energy is related to mass by the relation, energy equals mass times the square of the velocity of light, and he did it without using the doubtful electromagnetic field energy localization of his 1905 report. His simple proof depended only on the conservation of impulse when two similar bodies collide in the inelastic and elastic impact, and on the method of transforming coordinates in space developed by Lorentz. Professor Einstein's proof may be of historic interest, for text-books of physics in the future may contain it instead of the present more complicated proof. Such a situation has occurred before in other fields of physics.

DR. W. F. G. SWANN, of the Bartol Research Foundation, at the annual exhibit of the association reported his plans for apparatus to be carried on the ascent of the stratosphere balloon of the National Geographic Society. The set-up will be a new group of Geiger counters, similar to the group carried on the flight by Dr. and Mrs. Jean Piccard last summer, but incorporating certain improvements. The Piccard flight instruments, now historic, are part of the exhibit of the Bartol Research Foundation. Geiger counters are exceedingly sensitive electrical devices which register an electric "kick" when a ray or charged particle strikes a fine wire inside. If two of them are placed in line, and both of them register simultaneous "kick," it means that the same ray or particle has hit both wires, thus indicating that it came from the direction in which the two counters are aligned. The set-up for cosmic ray study consists of several such pairs, each pair aligned in a different direction, to catch rays from as many angles as possible. Dr. Swann stated that he is also considering sending up a "cloud chamber," coupled with his counter apparatus. A cloud chamber is a device that makes visible the path of a charged particle by means of a fog trail of condensed water particles, which can be photographically recorded. As a matter of economy in film, Dr. Swann said that this cloud chamber would be hooked up to the counter group by suitable amplification, so that an exposure would be made only when the counters registered a "kick."

RIM speeds of almost 1,400 miles an hour, or 2,000 feet a second, have been attained by a new refinement of the super-centrifuge developed at the University of Virginia under the direction of Professor J. W. Beams. The new apparatus is turned by an air turbine similar to those already in use in his laboratory. This turbine consists of a top-shaped piece of metal with inclined vanes against which streams of high-pressure air are directed. The air stream lifts the turbine ont of the cup in which it rests when still, spins it at high speed, and at the same time serves as a cushion on which the unit rides. At the high speeds the friction of air on the turbine becomes a matter of some importance, acting brake-fashion. For this reason, Professor Beams spins the "rotor" of the turbine in a vacuum. This is accomplished by suspending the rotor beneath the turbine on a slender piano wire. An air-tight box surrounds the rotor into which the wire passes through a tiny hole. Viscous oil fed into the hole lubricates it and at the same time seals it against the air. The box, thus sealed, is evacuated of practically all its contained air, and the rotor spins in a vacuum. Speeds attainable by the rotor are limited only by the strength of its own material. One experimental rotor, made of solid duralumin, was exploded by its own centrifugal force when it reached a speed of over 132,000 revolutions a minute. The portions of metal at its edge were experiencing forces of about 900,000 times gravity. If the total energy of spin could have been utilized in lifting the rotor against the pull of gravity, it would have raised it to a height of five miles.

SCIENCE has recovered thousands of dollars of valuable radioactive products from which gamma rays, so useful in cancer therapy, may be obtained. Professor George B. Pegram and Dr. John R. Dunning, of Columbia University, reported that the heavy ray-producing element polonium had been recovered from old radon tubes obtained from Memorial Hospital in New York City. In one test polonium equivalent to $2,100 was obtained by the new method. Polonium is the radioactive element discovered by the late Madame Curie, who, with her husband, also discovered radium. The scientific method consists essentially of separating the polonium from impurities by use of electric current in a solution. An every-day use of this electrolytic technique is in the silver plating of metal, like knives, forks and spoons. Using a variation of the common method developed by the electrochemist Professor Colin Fink, of Columbia University, Professor Pegram and Dr. Dunning employed

a rotating electric contact in their polonium-bearing solution. Revolving at speeds as high as 6,000 revolutions each minute the rim of the electrode moved with velocities up to thirty-six feet a second. In a sample extraction test 35 millicuries of polonium were obtained. A millicurie is the unit by which the amount of radioactive materials is measured. A gram of radium, worth $60,000, is equal to 1,000 millicuries. By obtaining thirty-five millicuries, polonium worth $2,100 was recovered.

CELESTIAL twins, a pair of giant "suns" revolving round and round each other millions upon millions of miles out in space, are revealing to astronomers secrets of star composition never before known for any other stellar object in the whole universe outside of our own sun. In three papers by Drs. W. H. Christie and O. C. Wilson, of the Mount Wilson Observatory; Dr. P. T. Oosterhoff, also of Mount Wilson Observatory, and Dr. Frank C. Jordan, of the Allegheny Observatory, the new discoveries about Zeta Aurigae were disclosed. An analysis of the outer vaporous chromosphere starlight shows that atoms of iron, nickel, titanium and aluminum are present. Light hydrogen gas was also found, plus atoms of calcium and titanium in an ionized state wherein a charge of electricity—an electron—had been stripped from them. The year 1934 has been an especially fortunate one for observing the eclipses of Zeta Aurigae, for only three times in eight years do eclipses occur. "At these times," explained Drs. Christie and Wilson, "the small hot star is passing behind the extended, tenuous atmosphere of the large one. As a result the spectrum of the smaller star shows the absorption lines due to the atoms composing these portions of the atmosphere of the larger one lying in the line of sight." By analyzing these spectral lines astronomers are able not only to tell what kind of atoms are to be found in the outer layers of the big star, but have indications about the heights at which the various kinds of atoms may be found.

MAN had nothing to do with the making of the recent drought in the West, any more than with the earlier period of abundant rains from 1900 to 1915, though he has been given blame for the one and credit for the other. J. B. Kincer, of the U. S. Weather Bureau, speaking before the meeting of the American Meteorological Society, said that during the years of abundant rain and expanding agriculture in the West, the belief that planting crops "made rain" became so general that the Weather Bureau called upon him to prepare an essay showing its erroneousness, which received wide publication. Now that the climatic pendulum has swung to the other extreme, he again found it necessary to combat the opposite error. He minimized the idea that the drainage of many small lakes and extensive marshes helped to cause the drought by "robbing the air of its moisture." Though on the surface an attractive theory, a little examination of the magnitude of the physical factors involved in weather quickly shows that the changes in surface water made by man are relatively insignificant. "But," the speaker continued, "man has contributed very materially to the damaging effect of the Great Plains drought, through extensive cultivation where it never should have been practised. This has intensified the drifting of soil and contributed to severe dust storms which were important unfavorable features of the recent drought. The remedy here is fewer cultivated fields; more natural vegetation; more grass lands without too close grazing, and any device that would diminish the surface velocity of the wind and conserve soil moisture. In such things as these he is not helpless."

DENTAL decay is beginning its attack at an earlier and earlier age. About half the two-year-old children in large cities have at least one cavity in their teeth, according to Dr. John Oppie McCall, director of the Guggenheim Dental Clinic, New York City. Dr McCall likened the present-day search for the cause and means of preventing dental decay to the old search for the Philosopher's Stone. To draw this parallel is more than mere fancy, he said. No one will deny that health is more valuable than wealth and it is not difficult to demonstrate that uncurbed dental decay is a common, perhaps invariable cause of ill health. The wide spread of dental decay in the population is well known, over 95 per cent. being involved. The search for the Touchstone of Prevention has long been under way, antedating even the search for the alchemists' Elixir. The importance of diet in preventing and controlling dental caries is known, but investigators do not yet know how the foods and food factors like vitamins which have been found helpful do their part. Neither is it known which elements in the diet are of prime importance and which of only secondary importance. The various elements in the situation which have been the subject of careful study are the influence of vitamins A, D, C, mineral balance, sugar intake, acid-base balance and raw foods. Dr. McCall urged the cooperation of physicians, bacteriologists, nutritionists and dentists in attacking this fundamental problem.

ACCURATE and almost instantaneous recording of rapid changes in temperature, humidity and barometric pressure during airplane flights for gathering weather forecast data is possible with the use of an improved type of meteorograph which has been developed in the division of meteorology at the Massachusetts Institute of Technology. Streamlined to minimize air resistance and thus avoid lowering the "ceiling" of light airplanes, the instrument is extremely sensitive, eliminating the lag in recording behind true conditions which is experienced with old type meteorographs. Enclosed in an aluminum case and resembling in appearance a tiny Zeppelin, the instrument is only three inches in diameter and about fourteen inches long. It is suspended from the wing of an airplane in a specially designed frame, making its recordings by means of minute tracings on an inch-square piece of smoked glass. The design of the instrument, following the principle of the Jaumotte sounding balloon meteorographs used by the institute, combines sturdiness, streamlining and great sensitivity. Due to the high-rate of climb of modern airplanes, the temperature and humidities to be continuously recorded by the meteorograph

change very rapidly. If the thermometer and hygrometer are not sufficiently sensitive, their indications lag and can not be used when exact measurements are required. The only way to obtain reliable data from the old type meteorographs was to climb slowly, an unsatisfactory solution. To increase sensitivity a bimetal thermometer one two-hundredth of an inch thick and suitable for use in the fastest climbing planes was employed. The traditional human hair in the hygrometer for recording humidity was also used. The new instrument has been tested on the meteorological research plane of the institute for three weeks with excellent results.

THE tiny hearts, or nuclei, of atoms which science can study only by breaking them apart in atomic bombardment experiments are really "atoms within atoms," according to Professor David R. Inglis, of the University of Pittsburgh. Professor Inglis's "atom within the atom" statement is based on mathematical studies which interpret the magnetic properties of the nucleus in good agreement with observed experimental data. The atom consists, Professor Inglis explained, of the nucleus with many electrons gyrating about it in such a way that the atom may have quite strong magnetic properties, and the correct theory of the motion of these electrons has been recognized by its success in explaining the observed magnetic properties of the atom. The story is repeated inside the nucleus, and the laws of motion of the particles in the nucleus are recognized by explaining the magnetic properties of the nucleus. It is shown that the nucleus actually seems to be a tiny and intricate atom within an atom.

A POTENT factor in the survival of human and other animal races is the mechanism the body has built up for defending itself against invading disease germs. How this mechanism works was described by Dr. Reuben L. Kahn, of the University of Michigan. Dr. Kahn's research on this subject won him the annual award of the association last year. The defense mechanism is most active in the outer ramparts of the body, the skin and mucous membrane lining nose and mouth, because through the ages these tissues have been first to make contact with micro-organisms. Dr. Kahn found that when "germs" enter the body, this first line of defense in skin or mucous membrane promptly rallies to the attack and anchors the invading germs at the point of entry, trying in this way to prevent their penetrating further into the body. Once the harmful germs are anchored, other forces of the body destroy the invaders. A second line of defense has been built up in the blood stream. According to Dr. Kahn the state of being immune to a disease, or able to resist infection, is therefore a defensive state. This defense mechanism operates against other foreign invaders besides germs. Among these are certain pollens, wool, fur and certain foods. Hayfever resulting from exposure to the pollen of ragweed, for example, is not a state of over-sensitiveness, but of over-defensiveness. The defense mechanism may not be sufficiently active to cope with certain micro-organisms, in which case disease results. Or it may be overactive to such a degree that exaggerated local and general responses will result from tiny amounts of the foreign invader.

ORCHIDS, flowers of wealth and luxury, demand luxurious infant food, experiments by Dr. Lewis Knudson, of Cornell University, have shown. He told an audience of plant physiologists how he has been able to grow orchid plants from seed, if he provides the seed with sugar. Otherwise they will not sprout. It was thought for a long time, before Dr. Knudson demonstrated otherwise, that orchids could not be grown at all without the fungi always found swathing their roots in a state of nature. Dr. Knudson also reported some curious effects on the growth of ferns when their spores, or one-celled propagating bodies, are treated with x-rays. The young stages of the fern plant that spring from such irradiated spores have abnormally large chloroplasts, or chlorophyll-bodies within the cells. At first these are irregular, then they assume the normal round shape, but are still several times the size of ordinary chloroplasts. Two full-grown ferns which he has succeeded in growing from an x-rayed start still have the abnormal chlorophyll bodies.

SUGAR cane makes glucose and its related "reducing sugars" on sunny days before it forms cane sugar and starch, as reported by Dr. Constance E. Hartt, Hawaiian plant physiologist. Dr. Hartt is working on sugar-cane problems for the Hawaiian Sugar Planters' Association. In the experiments, samples of cane leaf blades and sheaths were gathered at one-hour and two-hour intervals over periods of twenty-four hours, and analyzed for the various kinds of sugars they contained. Reducing sugars, like glucose, were at their maximum when the sunlight became strongest, but as afternoon progressed their concentration fell off. On the contrary, the cane-sugar and starch contents of the leaves continued to increase until nightfall. This is interpreted to mean that the cane-sugar and starch are formed from the reducing sugars, which is in accordance with the usually accepted plant physiological theory. However, during the hours of strongest sunlight, reducing sugars are formed faster than the plant can change them into cane sugar or sucrose. Dr. Hartt also reported another study on the activity of the enzyme known as invertase, in converting glucose into cane sugar in the leaves of the plant.

PROFESSOR WILLIAM K. GREGORY, of Columbia University and the American Museum of Natural History, reported on the evolution of the pelvis, or girdle of bone that supports the hips, all the way from fish to man. The first pelvis was an exceedingly simple affair, according to Professor Gregory. It consisted simply of a couple of flat rods of bone, not attached in any way to the spine, which helped to support the rearmost pair of fins in fishes. When animals left the water and came ashore as amphibians, the pelvis became considerably more elaborated. It was "like a broad triangle surmounted by a short-stemmed, lop-sided Y." From these humble beginnings, the bony support of the hind legs has become progres-

sively more and more solid, first enabling animals to progress freely upon all fours with body clear of the ground, and finally, in erect-walking humanity, carrying much of the weight of the internal organs, and freeing the front limbs to become arms.

SOYBEAN plants deprived of sulphur in the soil get sick, and show it by turning yellow-green, and producing smaller leaves and thinner stems. These external symptoms, and an analysis of internal derangements due to the lack of sulphur, were described by Dr. Scott V. Eaton, of the University of Chicago. The external symptoms are similar to those caused by lack of other elements, such as potassium, phosphorus and calcium. Dr. Eaton explained that starvation in these necessary minerals interferes with the formation of one of the plant's indispensable enzymes, reductase, thereby preventing the plant from making use of nitrates, necessary for the formation of protein foods and the upkeep of its living protoplasm. Stopped from this normal nutritional function, the plant piles up soluble nitrates and organic nitrogen compounds, as well as all forms of carbohydrates. Sulphur starvation thus apparently works its harm through causing starvation in other, quantitatively more important, elements in the plant's life cycle.

LONDON fog is largely made by London hearth-fires. All cities that gloom along through dim-sunned winters have themselves to blame, to a very large extent. Minute particles of ash and soot go up through their chimneys in smoke. These tiny solid particles in the air, with others from other sources, serve as "nuclei" for the condensation of water vapor and the formation of cloud, fog and mist droplets, and eventually for raindrops and snowflakes. Such condensation nuclei, according to Dr. Helmut Landsberg, of Pennsylvania State College, double their numbers as soon as chill weather comes on in the fall and more fires are lighted. Dr. Landsberg based his conclusions on over a thousand observations of air conditions. Seven hundred of these were made on a mountain in Germany, a few over the North Atlantic Ocean, and the rest at State College, Pa. Over the ocean the nuclei are largely salt crystals, and their number is relatively low at most times. Migrating masses of air from Arctic regions are also low in nuclei counts, so that it is possible to tell with considerable accuracy the general source of a given air mass by counting the solid particles in it.

SHEEP in the Northwest developed a highly destructive epidemic of tularemia or "rabbit fever" last spring, which Dr. Cornelius B. Philip, U. S. Public Health Service, reports was borne by the parasitic ticks common on the range. Corroborative evidence included the death of many jackrabbits from tularemia at the same time, the discovery of tularemia bacteria in the bodies of some of the ticks, a case of tick-transmitted human tularemia, and bacteriological tests on the blood sera of diseased sheep. Dr. Philip had as associates in the research William L. Jellison, of the Rocky Mountain Spotted Fever Laboratory of the U. S. Public Health Service, and H. F. Wilkins, of the Montana Livestock Sanitary Board.

SOMETHING very much like hibernation, or the almost death-like sleep in which certain animals rest for parts of their lives, can be produced by heavy water, containing the recently discovered double-weight hydrogen atoms. Experiments indicating this were reported by Dr. T. Cunliffe Barnes and E. J. Larson, of Yale University. Dr. Barnes and Mr. Larson used flatworms, a relatively primitive life-form, in their investigations. Flatworms kept for months in a dilute solution of heavy water in ordinary water were still the same size as they had been at the start. Other flatworms, kept in pure ordinary water as "controls," had lost four fifths of their size after the same period. Slower chemical reactions of digestion, and slower life-processes generally, indicated the "sleepiness" of the animals in the heavy water solution.

DRIED stocks of living bacteria needed for later study can be kept conveniently and at low cost. How the technique of drying out certain bacterial types and still keeping them alive can be applied to the species that thrive only when they are not exposed to the air was described before a medical audience by Dr. Alden F. Roe, of the George Washington School of Medicine. The bacteria are grown in suitable media until there is a considerable quantity of them. Then the fluid is centrifuged, to concentrate them. The concentrated suspension of bacteria is transferred to strips of filter paper, and drying is carried on rapidly in the cold, under vacuum. Then the strips are transferred into small sterile glass tubes, the air exhausted, and the tubes sealed until the bacteria are needed for experimental purposes. Bacteria of two botulinus types, as well as several other less harmful strains, have been alive and ready to resume growth after a year in vacuum-tube storage.

BEES are suffering from poison dusts spread from airplanes and intended for the destruction of harmful insects. The harm done by this wholesale spreading of insect poison by the rapid and cheap airplane method was described by Dr. J. E. Eckert and H. W. Allinger, of the University of California. The airplane dusting method, Dr. Eckert stated, is responsible for the reduction by a round million in the number of hives or colonies of honeybees in the United States during the past three decades. The bees are not always, perhaps not usually, affected by the poisoning of the flowers of the crop plants being protected by the dusting. The mischief is apparently more often caused by the drift of part of the deadly dust into the flowers where they are working. Bees gathering nectar are usually killed by the poison before they can reach the hive. Pollen-gathering bees, since they do not swallow their gleanings but carry it in hair-baskets on their legs and bodies, get home with the poisoned food and give it to the young bees in the brood, thus cutting off the increase of the colony at its source.

How far corn roots grow through the soil has been determined by a new method, described by Dr. J. D. Sayre and Dr. V. H. Morris, of the Ohio State Agricultural Experiment Station at Wooster, Ohio. The method

depends upon the fact that the element lithium, rare in ordinary soils, can be taken up by plants without apparent injury, and afterwards can be made to show its presence by a peculiar red color when burned. In the tests, a quantity of lithium salts is mixed with earth, and a core of this "lithiated" earth is planted twelve to eighteen inches deep between corn rows after the last cultivation. After harvest, parts of the dried plants are burned in the laboratory, and the flame examined with the spectroscope. The plants showing the characteristic red line of lithium are assumed to have sent their roots into the "lithium spot" in the soil. The possibility that the lithium may have moved through the soil, in solution, is ruled out on the ground that "it enters into the base exchange complex of the soil.

CHRYSANTHEMUMS of a special kind are grown not for ornament but for the production of insect poison. Specifically, they are known as pyrethrum, and their extract, pyrethrin, is one of the most widely used means of chemical warfare against many insect pests. Dr. Brooks D. Drain and G. A. Shuey, of the University of Tennessee Agricultural Experiment Station, told how especially desirable strains of pyrethrum can be propagated without risking the loss of their valuable high poison content. The propagation consists simply in dividing the plants, much as ornamental chrysanthemums and other flowers of the same type are divided. If plants are grown from seed, the pyrethrin content is uncertain, but this vegetative propagation eliminates the risk of hybridizing with low-grade pyrethrum strains. The best pyrethrums may contain as much as two per cent. pyrethrin, while poor plants have as low as 0.6 per cent.

THE popular belief that men are mentally superior to women, and that the number of extremely intelligent is greater among boys than among girls, was dispelled by a report by Professor Paul A. Witty, director of the psycho-educational clinic at Northwestern University. The popular misconception has been given support, Professor Witty pointed out, by observation of the outstanding proportional achievement of men in music, art, science and literature, and also by studies that have been previously made of small numbers of gifted children. It fails, however, when large numbers of boys and girls are studied with the unprejudiced eye of scientific mental mental measurement. Altogether, 14,149 boys and 13,493 girls, all students in secondary schools, were included in the study.

RAT fleas spread typhus fever in America, but they are not mere mechanical carriers. The virus of the disease multiplies in the body of the flea, according to a report by Dr. R. E. Dyer, of the U. S. Public Health Service's National Institute of Health. The investigation which disclosed how typhus fever is spread in this country has been carried on over a period of years by the federal health service. During the course of the investigations, a number of the men working on the problem contracted the disease.

INDEX TO ADVERTISEMENTS

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