SCIENCE NEWS

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COSMIC RAYS

DR. ROBERT A. MILLIKAN and Dr. George H. Cameron, of the California Institute of Technology, have just reported to the National Academy of Sciences the results of their latest researches on the biography of atoms. The work that he has been doing for the last few years has demonstrated, says Dr. Millikan, "that the cosmic rays are the signals sent out through the heavens of the creation of the common elements out of positive and negative electrons." The electrons are the building units of which all atoms are believed to consist.

The next important question, he says, is "Where are these creative processes going on?" Now, he believes, he can answer this with a considerable degree of assurance. He thinks that it is in interstellar space.

Only two possible places are conceivable where such atom building can take place, he says. One is in the stars themselves, where pressures, densities and temperatures may be extraordinarily high. The other is in the interstellar spaces where "pressures, densities and temperatures are all extraordinarily low."

"In both of these localities," he remarks, "matter exists under extreme and as yet unexplored conditions, and in view of the last thirty years of physics it would no longer be surprising if matter were again found to behave in some hitherto unknown and unexpected way as a new field of experimentation is entered."

The first reason that leads Dr. Millikan to reject the stellar origin of the cosmic rays is that in such a case the sun, closest of all stars, should by virtue of its closeness, send us more of the rays than any other star. "But the fact is," he states, "that all observers are agreed that the change from midnight to midday does not influence the intensity of the cosmic rays. This can only mean that the conditions existing in and about the sun, and presumably also in and about other stars as well, are unfavorable to the atom-building processes which give rise to these rays." Consequently, the favorable conditions must be found away from the stars.

The second reason has to do with the measurements of the absorption and total energy of the rays. The hardest and most penetrating of the rays observed are completely absorbed in passing through 70 meters of water. "This means," says Professor Millikan, "that, even if the atom-building processes went on inside a star, the resulting cosmic radiation could not possibly get out, but would all be frittered away in heat before emergence, save in the case of those rays that originated in the star's very outermost skin—a skin equivalent in absorbing power to a hundred or so meters of water."

But the total energy coming to the earth in the cosmic rays is about a tenth of that in the light and heat coming from all the stars except the sun. This could not be the case if the rays originated within the stars, for then the rays from the interior, as they emerged through the outer layer of the star, would be transformed to heat. The heat outflow would then be more than ten times as great as the flow of the rays from the star's surface. This, also, leads to the conclusion that the origin of the rays is in interstellar space.

Modern astronomical views accord with this theory. These propose that the energy of the stars is furnished by disintegration of their atoms. The atoms, it is supposed, break up into the electrons of which they are made, and so turn into a pulse of energy which is frittered away as heat. There should be a ray, then, corresponding to this pulse of energy, of even shorter length than the shortest and most penetrating of the cosmic rays. Such a ray has not yet been found, but Dr. Millikan points out that this is no evidence that it does not exist within the stars. It may all be turned to heat before it gets out.

For these reasons, therefore, Dr. Millikan and Dr. Cameron suggest the cycle of atomic life. The electrons are floating around freely in interstellar space. Under the influence of the peculiar conditions of outer space they condense into atoms. The atoms then condense into stars, and the stars again disintegrate into ether waves and heat or light.

Only one more step remains. Dr. Millikan points out that if this is the whole process, all the free electrons of which atoms are built should have been used up long since. "The only possible answer," he says, "seems to be to assume that these building stones are continually being replenished throughout the heavens by the condensation of radiant heat into positive and negative electrons with the aid of some, as yet, wholly unknown mechanism." To work out this mechanism is the next step.

THE SPEED OF LIGHTNING

THE speed of a lightning flash has been measured for the first time in history. It takes about one seven-thousandth of a second for it to complete itself. No part of it lasts more than approximately one thirty-five-hundredth of a second.

The old dispute as to whether lightning strikes downward from the clouds or jumps upward from the ground has also been settled. It does both. It starts from the cloud and the ground at nearly the same instant, and approximately one seven-thousandth of a second later the two ends unite in mid-air.

These facts, representing the first actual measurements of the speed of lightning, were determined by Dr. C. V. Boys, British physicist, who is spending the summer working in the private laboratory of Mr. Alfred L. Loomis, of Tuxedo Park, N. Y. Professor Boys obtained his measurements with a special camera which he has patiently carried about the world for twenty-six years, attempting hundreds of photographs in vain, until a New York stroke of lightning proved to be his real stroke of good luck.

The camera has two lenses instead of the usual single lens. They are mounted on a disk and whirled rapidly while the camera is pointed at a cloud which promises good lightning flashes. When the flash comes, the camera is closed and the plate developed.

Since two moving lenses have been used, a double picture is obtained, each image slightly displaced in a direction opposite to the other. By appropriate optical measurements and geometrical calculations of this displacement the direction and rate of travel of the flash can be determined. Its duration can be learned from the width of the streaks on the plate, blurred by the motion of the lenses.

A detailed report of these measurements and a description of the methods employed are published in *Nature*.

SYNTHETIC CANE-SUGAR

THE proposition of commercial synthetic cane-sugar is pure "moonshine," in the opinion of Sir James C. Irvine, Britain's greatest sugar chemist, speaking at the Institute of Chemistry of the American Chemical Society at Evanston. Even admitting that the two mother substances of common sugar, glucose and fructose, were to be obtained from nature, the last step in uniting the two presents enormous difficulties. Apparently there is little hope of a process much more economical than that of Professor Ame Pictet, whose discovery of synthetic sugar received wide publicity recently.

In a survey of the very difficult laboratory researches leading to synthetic sugar, Sir James pointed out the chameleon-like habits of both glucose and fructose. Each of these, instead of being a single kind of sugar, is really a small host in itself. Actually several different species of sugar ride under the one common name. While these are naturally much alike, it is only one particular kind of glucose combined with one specific fructose which will yield genuine cane-sugar. To add to the problem, the different varieties change into one another, unobserved, during manipulation.

A change from one variety of glucose or fructose to another is usually the transfer of oxygen atoms from one carbon atom to another within the sugar group. No material is lost or gained, so that the ordinary analytical chemist, using balances and common laboratory apparatus, would not suspect that anything had happened. Neither Pictet nor Irvine has yet demonstrated clearly just what kind of each sugar goes into the cane-sugar combine, so that it is still impossible to write the formula of the final product with certainty.

Although the glucose component is commercially available at low cost from corn, the fructose is more expensive than natural cane-sugar itself. In view of the fact that the production of a teaspoonful of synthetic cane sugar would probably take the time of a highly-paid chemist for several months, to say nothing of supplies and overhead, it is thought that the practical production of sweetness will be left to the lowly beet and cane for a long time.

FISH CULTURE IN THE SOUTHERN STATES

A GIANT Brazilian shad weighing 200 pounds, another big fish known locally as "dourado," and a fresh-water species with red-gold flesh like a salmon, are among the South American fishes recommended as possibilities for fish culture in the southern United States by Dr. R. von Ihering, the Brazilian naturalist.

The possibilities of Brazilian fresh-water fish have only begun to be realized even in Brazil, Dr. von Ihering states. Hitherto they have attracted only the attention of zoologists and local fishermen, but now economic studies are being undertaken, with interesting results.

The real prize of the Brazilian fresh waters is the "dourado," a fine black-striped gold-scaled fish that reaches a length of three feet and a weight of 60 pounds. It yields a great mass of roe as well as of marketable meat; its eggstock frequently contains as many as two and one half million eggs, as against a mere half-million in such familiar fish as the carp and members of the salmon family.

The fish with the salmon-colored flesh is known to the native Indians as "piracanjuba." It is rated second only to the dourado by them. One of their favorite methods of preparing it is to grind up its red flesh and make it into a thick soup or porridge mixed with tapioca.

Dr. von Ihering states that there are so many fish in the Brazilian streams that during the spring when the runs take place, they can be netted by the boatload at the foot of every waterfall. A casting net nine feet in diameter often brings in ten or twenty large fish at a haul.

THE SPROUTING OF OATS

HARDSHIP in youth is good for oats, as it is said to be good for human beings. This grain of the North thrives best and ripens earliest when it is sprouted at a low temperature, experiments by Prof. N. Maximow, noted Russian plant physiologist, indicate.

Professor Maximow exposed seed grain to temperatures of about 42 degrees Fahrenheit, only about ten degrees above freezing. The stalks from these seeds headed out earlier than those from seeds sprouted at a warmer temperature. This was true even when the early chilling period lasted only for a few days, and the two lots of grain were grown at the same temperature for the rest of their lives. It was found that this treatment held good for all plants that have a late ripening period.

The experiments give scientific point to an old Russian folk saying: "If you want to grow rich fast, sow your oats in the mud." It has long been held by the peasants that the best time for sowing oats is while the fields are still muddy (and hence chilly) from the melting of the winter's snow.

Another striking example of the effect of early influences was obtained by Professor Maximow, working on the influence of light. He found that the effects of artificially lengthening or shortening the day for plants were just about as pronounced when the treatment was carried on for a short period during the early seedling

stage as when it was persisted in to maturity. According to its specific nature, a plant would ripen its seeds early under the stimulus of lengthened or shortened daylight hours, even though that stimulus had been applied weeks before the ripening period and then withdrawn.

Plants are not concerned primarily with the whole of the white daylight when they respond to artificial darkening, Professor Maximow discovered. He tried cutting off parts of the light supply, and found that when red and yellow light was withdrawn the plants acted as though they were in the dark, so far as their response to the length of day was concerned.

PHOTOGRAPHS AND CHARACTER

READING fortunes in faces is impossible for practical purposes, according to two psychologists who have conducted an experiment to determine whether vocational aptitude and success can be judged by careful study of photographs.

College graduates destined to become famous lawyers or surgeons carry no shining mark of success upon their youthful faces in photographs, at least none that an employer can rely upon. College boys who will never rise beyond a clerk's desk in a law office are apt to look just as keen and promising at graduation time.

The psychologists, Dr. Carney Landis and L. W. Phelps, of Wesleyan University, selected the five most successful lawyers, doctors, teachers and engineers in a big university class that graduated 25 years ago, and also the five graduates who have attained the least worldly success in each of these fields. Photographs of the 40 men taken at graduation and 25 years later were shown to psychology students, who judged the success or failure of each and the line of work that would suit him best.

"In practically every case the observers disagreed and the same subject might be assigned to from ten to fifteen different vocations," the psychologists state, in reporting their investigation to the *Journal of Experimental Psychology*.

One successful engineer was thought by 10 of the 20 student judges to be a clergyman. Six of them thought he was a successful clergyman and four decided that he was a failure at his church career. Another man, who, 25 years after graduation, holds a minor teaching post, was rated as a successful banker by six of the judges.

The popular belief that we can judge a man's ability and personality from seeing his photograph is not borne out by the evidence, the psychologists conclude. A photograph included in a letter of application for a job will not enable an employer to gain any positive idea of an individual's talents or his character.

ITEMS

A NEW treatment for prolonging the lives of stored apples attacked by a disease called "brown heart" is recommended by Dr. C. West and Dr. and Mrs. F. Kidd, working at the Low Temperature Research Station at Cambridge, England. Apples continue to live and breathe after they have been removed from the trees, and this breathing soon contaminates the atmosphere of the place they are stored in with an excess of carbon dioxide, which causes the serious disease, "brown heart." The experiments made here showed that by keeping the apples in a "gas store" in which there is about 11 per cent. of oxygen and 10 per cent. of carbon dioxide, the breathing of the apples is reduced and their storage life increased by from 50 to 100 per cent. Accidental variations in the ventilation is suggested by these investigators as the cause of the present uncertain success in overseas transport of apples.

OF the 1,177 different kinds of trees that are found in the forests of the United States, 137 have special medicinal virtues, Professor Ernest F. Stuhr, of Corvallis, Oregon, told members of the American Pharmaceutical Association at the opening session of the Portland annual meeting. Professor Stuhr has made a comprehensive investigation of all the trees in the country which are now or may be of medicinal value.

IN 1880 jellyfish were observed to be gaily swimming about in the huge fresh-water tank which houses the large Victoria regia lily in the Botanic Gardens, Regent's Park, London. No one knew how these jellyfish first entered the tank. Their appearance was a complete mystery, but they were quite welcome, as they looked very pretty moving slowing about like small electric light globes. For three years they inhabited the tank, and then in 1883 they disappeared as suddenly as they had come. It was thought at first that the draining of the tank for six months in the year probably explained the mystery, for no jellyfish like being out of water. Now after an absence of forty-five years the jellyfish are once more swimming in the same tank in which they were first found. This family of the jellyfish has never been found at any other place except Regent's Park.

HAVING imported eucalyptus trees from Australia to supply timber for mining purposes, the South Africa Department of Agriculture has now been obliged to import wasps on a large scale, to protect their new trees from attack by the snout beetle. The latter had become a serious pest among these giant trees in South Africa, although Australian and American trees have not suffered from it. Investigations by F. G. Tooke, of the South African Department of Agriculture, showed that this insect is also present in Australia, but that it is not at all dangerous because it is itself attacked and killed by a tiny wasp, which lives parasitically in the eggs of the snout beetle.

THE commercial canners are beginning to realize that aluminum may turn out to be the ideal material for the manufacture of containers for canned foodstuffs. Dr. H. Serger, a German investigator, has already obtained encouraging results on this point. He has found that aluminum is much less attacked by fruit acids than is the tin of the usual tinned iron cans.