SCIENCE NEWS

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MEASURING THE ENERGY OF THE SUN

THE sun is a variable star. This central fire of the planetary system does not glow with a steady heat, but flickers from day to day and from year to year, and the vagaries of our earthly weather must depend at least partly on the sun's variations. This opinion, which has been supported for many years by Dr. C. G. Abbot, of the Smithsonian Institution, finds new support in evidence produced by a new system he has devised for measuring and recording the changes in the energy reaching the earth from the sun.

Dr. Abbot calls attention to the work of H. H. Clayton, who has announced that he finds variations of weather caused by solar changes. But many meteorologists have not been convinced that the sun really varies. They fear that the complicated measurements of Dr. Abbot, hindered as they are by the haziness and humidity of the earth's atmosphere, are not conclusive. The variability which he reports, they suggest, may all be due to unavoidable atmospheric sources of error.

Dr. Abbot now announces a very direct test that should settle the question. Although it is impossible to do the measuring from a point outside the atmosphere, yet it is possible to select times when the transparency and other affecting qualities of the air are closely alike and the sun stands at equal height above the horizon. At such times the solar heating should vary only if the sun does.

Selecting the month of July in the years 1910 to 1920 for his test, he collected results observed on Mount Wilson for all days of practically constant atmospheric conditions. The average monthly values thus selected he compared with those obtained by the usual process and heretofore published. He also compared them with the average monthly numbers of sun spots. The three curves that express his results run along very closely together. They show that the sun's heating in July, 1917, averaged over 2 per cent. above that of Julys, 1910 and 1911. Correspondingly, the sun spot numbers were 117 in July, 1917, and only 14 and 3, respectively, in Julys, 1910 and 1911.

Not content with this proof of the reality of long-range solar changes, Dr. Abbot rearranged the measures in a way to test short-interval solar variation. For this purpose he picked out from the new data all the days that gave high values of solar heating, and all those which give low ones. The average excess value for 51 high days was plus 1.43 per cent., and the average defect for 51 low days was minus 1.47. The same days, as already published four years ago, indicated on the average plus 0.51 and minus 0.42 per cent., respectively. Thus the days shown above normal by the new method of selecting times of equal atmospheric clearness had already been shown as above normal by the usual process, and *vice versa*. Of course the range as formerly published could not be so great, because the errors of observation could not be expected to fall the same in the two sets of data. Some days would be high and some low, not because of the sun's condition, but because the small observational errors helped to make them so.

Dr. Abbot's new method, he hopes, may be convincing of the sun's real variability. This will make all the more important and interesting his establishment under the joint auspices of the National Geographic Society and the Smithsonian Institution of a new solar observatory on Brukkaros Mountain in Southwest Africa. This site he selected last March after studying on the ground conditions in Algeria and Baluchistan. The mountain is 5,200 feet high in a desert where the yearly rainfall averages only three and one half inches. Roads and construction are rapidly going ahead under the supervision of Mr. A. Dryden, inspector of public works for the government of Southwest Africa. The complex apparatus required has been prepared, and the expedition is expected to go forward about August 1 in care of W. H. Hoover, director, and F. A. Greeley, assistant.

COSMIC RAYS

THE mysterious cosmic ray is due for another checking-up, this time in the heights of the Andes mountains. Dr. R. A. Millikan, of the California Institute, and Dr. G. Harvey Cameron, his associate, expect to make a scientific excursion during September to one of the highest lakes in Bolivia. Present indications show the best prospects in or near the Quimsacruz mountain range, a few miles southeast of La Paz. Peaks of 15,000 to 22,000 feet altitude and numerous lakes abound here.

The experiments with the new high-frequency penetrant radiation require the use of a deep alpine lake, free from radioactive salts, and at a very great altitude. It is possible in Bolivia to drive vehicles to altitudes higher than any lake in the United States. With this situation Dr. Millikan hopes to be able to conduct experiments at some location nearly a mile higher than the scene of last summer's epochal discoveries. Heavy apparatus will have to be transported. Despite the great altitude it is anticipated that the tropical warm season will afford the best chance to avoid frozen lakes.

By attaining the altitude of three miles or more from sea level, the Pasadena physicists expect to eliminate most of the dimming effect of the atmosphere on the cosmic rays. It is then possible by means of a delicate quartz-hair electroscope to receive and identify the remarkable energy emanations. Only by immersing the apparatus deep in a lake is it possible to obtain a blank control test, which is compared with the reception of radiation in the open.

A NEW VACUUM SWITCH

RADICAL changes in electrical engineering practice are expected to follow the recent tests of the vacuum electric switch, the first outstanding product of the new high-

tension laboratory of the California Institute of Technology. The new discovery is by R. W. Sorensen, professor of electrical engineering in the institute.

Turning off a one-horse-power motor by the simple pulling of a switch releases a harmless blue spark, but when a hundred thousand-horse-power of current is flowing, any attempt to interrupt the flow in the open air is about equivalent to the setting off of a dynamite bomb. Enormous oil-immersion switches, sometimes occupying acres of ground, have been developed in the attempt to quench the terrific arc that follows the breaking of the circuit.

In contrast to the huge oil switches, Professor Sorensen's switch operates in a small glass bulb from which all possible air is exhausted. With the aid of Dr. R. A. Millikan's high-vacuum laboratory Professor Sorensen was able to remove all but one billionth of the original air content of the tube. Advantage is thus taken of the fact that an electric current will not travel through a vacuum.

For the tests held at the large Laguna-Bell switching station the Southern California Edison Company furnished a current of 1,000 amperes at 43,000 volts, while its inspecting engineers stood at a very respectful distance, expecting fireworks. Although the switch opened a gap only one inch across, the whole current of over fifty thousand horse-power stopped instantaneously without a tremor. The oscillograph record of the current flow, which can easily detect a thousandth of a second of after-disturbance, indicates as clear a break in the record as if somebody had sliced the paper with scissors.

With great city installations requiring the interruption of hundreds of thousands of horse-power of electricity the new vacuum switch promises to be of wide use. Simplification of the apparatus will mean extensive application to larger industrial motors—15-horse-power and up—now requiring oil-immersion switches.

SYMBIOSIS AND DISEASE GERMS

A THEORY that may have an exceedingly important bearing on the cause of many obscure diseases has been advanced by Dr. Aldo Castellani, who is internationally known as an authority on tropical disease.

There is a condition among microorganisms known as symbiosis, which in spite of its formidable sound simply means a close association of two or more organisms in a kind of alliance like matrimony, with many of its benefits, but none of its drawbacks. Dr. Castellani believes that this state of symbiosis may be responsible for many symptoms and even the cause of some diseases not yet fully understood. "It seems certain," he says in a report to the American Medical Association, "that there are diseases caused by a true symbiosis or association of two organisms neither of which alone is capable of producing the malady."

He cites, as an example, common itch, the eruptions of which are not due to the mite which causes it by burrowing under the skin, but to a pus-forming coccus that finds the skin irritated by the mite a particularly fertile field in which to increase and multiply. A similar condition maintains in the tropical malady, yaws, where the eruptions are likewise caused by an associated coccus and not the specific causative agent. Certain symptoms in severe cases of typhoid fever have been demonstrated, according to Dr. Castellani, to occur only in the presence of both the typhoid germ and another bacterium. Neither germ will produce the reaction alone.

BITES FROM POISONOUS SPIDERS

SPIDER bites are added to the list of afflictions that can be treated with a specific serum, according to a report made to the American Medical Association, by Dr. Emil Bogen, of Los Angeles.

While serious poisoning from spiders is not so common as is popularly believed, there is a species inhabiting the southern half of the United States that causes acute pain and sometimes death. It is known variously as the "shoe-button spider," the "hourglass spider" and the "black widow," the last being a reference to its pleasant conjugal habit of devouring its mate.

About half of the reported cases attributed to the work of the black widow occurred in California, said Dr. Bogen, and those received in the Los Angeles General Hospital were treated first with sedatives to relieve the intense agony from which the patients were suffering. Very little is known of the antibody formation to spider venom but experimental work has indicated that one bite confers immunity. This possibility led to the suggestion that some specific serum treatment might be helpful. Accordingly a sample of blood was obtained from a man who had recovered from a severe poisonous spider bite and injected intramuscularly into a patient who had just entered the hospital in great agony.

Since this patient improved after the treatment, the same procedure was followed in other cases with a much quicker abatement of pain than would have been expected without it, said Dr. Bogen.

"The results," he declared, "while not conclusive, are sufficiently encouraging to warrant the continuation of the use of convalescent serum in every case that is admitted following a poisonous spider bite, and a supply of convalescent serum is now kept at the hospital for this purpose."

CYCAD HYBRIDS

CROSSES between different species and genera of cycads, strange plants that have survived from days before the Age of Dinosaurs, have been made at the University of Chicago greenhouses by Professor Charles J. Chamberlain. To get the first crop of seeds from his hybrids, Professor Chamberlain will have to wait patiently for at least ten years. Then he can, perhaps, go on with his experiment with these "living fossils," survivors of an ancient forest where the plants stood intermediate between ferns and the higher seed plants of to-day. The account of the first successful steps in this long experiment will appear in the forthcoming issue of *The Botanical Gazette*.

Professor Chamberlain gathered part of the material for his work in the jungles of Mexico, and part of it from South Africa, Porto Rico, Cuba and Florida. Transferring the pollen from the male to the female cones was

a critical task, and waiting for the seeds to germinate after planting was a matter of months. The character of the leaves of the new seedlings shows that the parent with larger leaves is usually dominant, but a full study will have to be deferred until the plants are sexually mature and ready to produce cones of their own, and this will require at least a decade and possibly a quarter of a century. Cycads are plants of exceedingly deliberate growth; a stocky little palm-like tree five or six feet high may be the product of two or three centuries.

Though of unusual scientific interest, cycads have but little economic importance at present. A number of species are used for ballroom decorations and in the making of memorial wreaths, some of them are exploited by commercial starch factories and some are used as food although, in this case, precautions must be taken on account of an alkaloid poison. However, cycads or their near relations that have been dead for many hundreds of thousands of years have great economic value now, because these plants played a considerable part in the formation of the great coal beds.

GRAIN INSECT PESTS

IMMEDIATE fumigation to rid the 1926 wheat, corn and other cereal crops of insect pests immediately upon harvesting is urged by Drs. E. A. Black and R. T. Colton, entomologists of the U. S. Department of Agriculture, as a means of saving American farmers millions of dollars this year. Ignorance of control methods, it is claimed, costs farmers a large share of their profits each year by causing them to sell their newly harvested grain as soon as possible to avoid loss from insect attack. By treating it themselves at small cost they could hold their grain longer and realize later on good market returns.

"What the farmer or corporation with financial backing has found profitable the farmer with limited means will also find profitable," Dr. Black said. The Department of Agriculture has made a study of the various chemicals used as fumigants and recommends several as simple enough for use on farms, and harmless and effective if rules are followed. Among these are carbon bisulphide, carbon tetrachloride and a mixture of the latter with ethyl acetate.

Studies by Dr. Black and others have shown that nearly all cereal crops, except those of the far north, are more or less infested when the grain ripens in the fields at harvest time, and delay in getting the crop under cover where it can be treated gives the insects a chance to multiply and spread to other kernels. Even a single day's delay is costly. Fumigation can destroy every insect in the bins, but this is done more easily immediately upon harvesting.

Although the idea that insects generate of themselves from the "germ of the grain" has long been exploded, many farmers and grain dealers still believe in this virgin birth of insect pests, as many people believe that fleas just naturally grow on dogs. Study has shown that the grain insects fly and are not at all partial to harvested grain in bins and granaries. The rice weevil and grain moth winter in the bins but spend the spring and summer in the sunny fields of green corn and wheat and lay eggs on the wheat heads and corn ears. It is really when the grain is still in the "milk stage," or just teething as it were, when the troublesome infestation really begins.

ITEMS

THE scientific world is watching with interest the newly-elected chemist-president of Poland, Professor Ignatz Moscicki. Professor Moscicki has a difficult post attended by many complexities for which the exact habits of scientific thought should qualify him to cut through the tangle of international diplomacy with precision and logical clarity, according to editorial comment in *Industrial and Engineering Chemistry*. Much of Professor Moscicki's former work has been in the field of electrochemistry carried out while professor of chemical engineering at the University of Freiberg in Switzerland. After Poland was reestablished as a nation he resigned and became professor at the University of Lemberg, or Lwow as it is now called, to aid in the general development of Polish universities. He has been prominent in developing methods along such practical lines as nitrogen fixation, oil demulsification and aluminum manufacture and holds more than fifty patents in the chemical field.

IF wheat is being grown in a dry country where there is little water it is benefited most by a downpour when it is still in the early stages of growth. Professor Alvin Kezer, of the Colorado State Experiment Station, in a report to the American Association of Cereal Chemists, described a series of irrigation experiments in which it was demonstrated that water applied while the wheat was still young produced a lower yield, but the final product had a much higher food value than that produced when irrigations were given during the later stages of growth.

AN important step has been taken in routing the army of flukes, tapeworms and other animal parasites that are likely to prey on man's vitals. All these "worms" from every part of the world, though it is chiefly in the tropics that such pests abound, have been grouped, classified and described by the United States Public Health Service in a very complete key catalogue. The publication is of extreme professional importance to health officers, physicians and medical students, for it is so arranged that it enables them to recognize any such parasites with a minimum of effort and study.

IN connection with the Eighteenth Universal Esperanto Congress to be held at Edinburgh from July 31 to August 7 an international summer school with all courses given in Esperanto will be held. Science, medicine, folk lore, linguistics and international law are the branches of learning in which courses will be offered. Among the professors of various nations who will lecture are Professor Collinson, of the University of Liverpool; Professor Bujwid, of the University of Cracow; Dr. Pascal Deuel, of Leipzig; Dr. E. F. Fournier d'Albe and the Italian R. Orengo; Dr. Stromboli, of Pisa, and Mr. Tarelli, of the International Labor Office in Geneva.