

Sea Animals Hold Cold Light Secret

Biology

Following are reported some of the papers presented at the meeting of the Pacific Division of the American Association for the Advancement of Science with its affiliated societies at Pomona College in California.

Man will face new and important ways of controlling nature when he succeeds in demonstrating the mechanism by which tiny organisms of the sea produce light without appreciable heat, Dr. Charles A. Kofoid, of the University of California, declared in his presidential address before the Pacific Division of the American Association for the Advancement of Science.

Dr. Kofoid described the occasional outbreaks of luminescence in the ocean by night, when each breaking wave is accompanied by an outburst of flaming light, and the path of a vessel becomes an illuminated trail across the water. By day the water of the luminous sea is rusty red, and mottled with patches of color. The luminous outbreak brings death and destruction to tons of sea creatures, and has baffled attempts of scientists to plumb the mystery to its exact source.

The epidemics of light have been definitely traced to tiny sea animals with the long name of *dinoflagellata*, which sometimes develop and multiply with what seems like an astonishing ambition to cover the ocean. But what causes such enormous flares of growth is still to be explained.

The fact that the outbreaks occur so frequently off the Pacific coast of this country, rather than off the Atlantic, is a clue that local conditions of weather and sea geography may play their part in the mob drama of the *dinoflagellata*. Chemical analysis of sea water patiently made over long periods of time is also expected to reveal some evidence of the exact kind of water in which the creatures flourish. It is also possible that the organisms themselves produce some substance which favors their own growth, and that they flourish and multiply until the food supply becomes inadequate and then the surplus hordes starve.

The task of handling and experimenting with these delicate organisms is extraordinarily difficult, Dr. Kofoid said, because they are attuned to an environment of great constancy, and the changes in their environment which cause them to respond are slight compared with other creatures of the animal world.

"The secret of the production of

light without appreciable heat is locked up in the metabolism of these simple organisms of the sea," Dr. Kofoid said in conclusion, pointing out that some of the most inviting problems of biology are involved in understanding the relations of these organisms to the solar radiations on which they depend and in demonstrating the mechanism by which they release their stored-up reserves of energy.

Size of Pollen Influences Growth

Whether or not flowers will reproduce may be traced to the size and general appearance of the pollen grains, reported Miss Laura E. Shaw, of the University of Southern California. She separated pollen grains into four groups according to size and found that the third group, containing grains of from three to four-thousandths of an inch and comprising half of the grains studied, gave the highest percentage of germination, the rate being 75 to 80 per cent.

Burrowing Prehistoric

Gophers, or their ancestors of the Stone Age, cultivated the habit of burrowing assiduously, finding it a great help in the struggle for existence, E. C. O'Roke, University of California investigator, reported. This habit was developed by many different orders of mammals, particularly those belonging to the rodent family, no matter how wide their zoogeographical distribution.

Sunspots Now on Wane

Astronomy

Spots on the sun, supposed to be connected with magnetic storms and Northern Light displays on the earth, and which have been especially numerous in the last few years, have now begun to decrease in numbers. They wax and wane in a regular cycle and the maximum was reached about March, 1927. This announcement was made by R. S. Richardson, of Los Angeles.

This maximum came unusually soon, it was stated. Though there is an average interval of about eleven years between two times of most spots, the 1927 maximum happened only 7.3 years after the last maximum at the end of 1919. Only once

in the last hundred years has the interval been so short. That was nearly a century ago, when maxima happened in 1829 and 1837, a little more than seven years apart. The present waning cycle, despite the fact that large spots were seen unusually soon, shows signs that the total number of spots in it will be unusually small.

Studies Sunburn Rays

The numbers of spots on the sun are now decreasing, and with them will decrease the amount of ultra-violet rays in the sun's light. These are the rays that cause sunburn in large quantities, and cure rickets and other diseases when the body is exposed to less of them.

Studies made at the Mt. Wilson Observatory during the last four years show that the intensity of the ultra-violet rays, and the numbers of the sun spots are in striking agreement, said Dr. Edison Pettit. His measurements were made by comparing the amount of sunlight transmitted through a filter of thin gold to that through a similar silver filter. In certain months, the average ultra-violet radiation from the sun was fifty per cent. greater than in other months.

Sun Has Eye Lotion Element

The element boron, principal constituent of borax and boric acid, is also present in the sun, the astronomers were told by Dr. Seth B. Nicholson of the Mt. Wilson Observatory.

Dr. Nicholson, who in 1914 won himself a place in astronomical history when he discovered a previously unknown moon of the planet Jupiter, has been working with Nicolas Perakis on a study of the sun. This has been by means of the spectroscope, which analyzes the sunlight into the colored spectrum band, crossed by dark lines that reveal the solar elements causing them.

Hitherto none of the spectral lines given by boron when studied on the earth have been identified in the sun. However, when boron compounds, in which the element is associated chemically with other elements, are examined with the spectroscope, characteristic bands in the spectrum result. Dr. Nicholson and his associate have found these bands (*Turn to next page*)

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in the spectra of light from sun spots. Though these spots appear dark, they do so only by contrast with the brighter portions of the sun. They are really very bright themselves.

Dr. Nicholson pointed out that nitrogen and carbon, two elements which are very similar to boron chemically, have only been located in the sun by means of the band spectra of their compounds.

Flames 20,000 Miles a Minute

Solar "flames," or prominences, that move out from the sun with speeds as great as 20,000 miles a minute, were described by Ferdinand Ellerman, of the Mt. Wilson Observatory.

These prominences have been studied by means of the spectroheliograph, an instrument that permits them to be photographed in the light of a single color. They consist largely of hydrogen. Among the interesting ones that he has studied recently, Mr. Ellerman told of one that expanded from a height of 100,000 miles above the sun's surface to more than 200,000 miles a few minutes later.

Tests Sunburn Sensitivity

Physics

Whether or not you sunburn easily may now be tested in a doctor's office without going to the seashore. Dr. Robert C. Burt, of Pasadena, told of a new instrument that he has invented and calls the "erythemameter." It measures sensitivity of a person to erythema, as the physician terms painful sunburn.

Erythema, or sunburn, is caused by the ultra-violet rays in the sun's light. It can also be caused by ultra-violet light from a quartz tube mercury vapor lamp, or one of the other forms of lamp now being used in the treatment of rickets and other diseases. In Dr. Burt's instrument such a quartz lamp is contained in a light-tight box from which the ultra-violet rays can escape through a hole about two inches square. This opening is placed directly against the bare skin of the person being tested.

A set of filters in back of this hole cuts off more and more of the rays so that the skin at one edge gets the full benefit of the rays from the lamp, while that at the opposite edge receives none. After being exposed to this apparatus for ten minutes, the untanned skin of anyone becomes burned at the side receiving the most

rays. The distance that the burned area spreads measures the person's sensitivity.

As it is also desirable to measure the effect of varying exposures on sun-burning, a shutter is provided behind the opening also. This moves across the hole in a direction at right angles to that at which the intensity varies. When the exposure is complete it has moved completely across. The result is an actual curve drawn on the subject's skin which shows how long an exposure he can stand to ultra-violet rays of any intensity.

The instrument is expected to be useful to physicians who are now using ultra-violet rays in the treatment of disease. Over exposure of a sensitive person to them may be very harmful, and by making a test with such an instrument serious effects can be prevented.

Dr. Burt also described another instrument of his invention that measures intensity of ultra-violet light, either from the sun, or an artificial source. It makes use of a photoelectric cell, in which light is converted to electricity, but a cell made of quartz, instead of glass, which is opaque to the rays.

"The instrument is so portable and easy to use," says Dr. Burt, "that the day may come when up-to-date bathing beaches will have an observatory giving out the intensity of the sunburn light in the sun, so that each person may stay out just long enough to become a delicate brown without becoming severely burned."

Thunderstorms in March

Meteorology

California, particularly along the coast, has the reputation of immunity from severe electrical storms. However, they do occur, and during the last few years several large oil storage tanks have been ignited by lightning, Dr. Charles C. Conroy told the members of the meteorological section.

March is by far the month in which they are most frequent, he said. Then follow April, January, February and May. The least number are in December, with November and October next in freedom from them. A number also happen in late August and September. He has also studied the time of day that they occur, and has found that in Los Angeles most are between two and three in the

afternoon, the warmest part of the day in winter and spring. Different years rate quite differently in numbers. Eighteen were recorded in Los Angeles in 1918-19, but from January, 1914, to September, 1916, none were noticed. Practically all of the storms studied were mild, and only three or four really severe. Some that were mild in the downtown district, however, did considerable damage in nearby mountain or foothill districts.

Ocean Maps Aid Long Forecasts

Weather maps now made by San Francisco Weather Bureau officials, covering the Pacific Ocean as far as the Aleutian Islands and the Philippines may aid in long-range weather forecasts of the California region and the Western United States. So the members were informed by L. E. Blochman, of Berkeley.

In general, said Mr. Blochman, seasons tend to follow the conditions prevailing during October and November, when the California rainy season opens. Sometimes, however, as happened last season, they change. He believes that study of the low pressure area around the Aleutian Islands is of considerable importance.

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