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THE COLD LIGHT OF SEA ANIMALS

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, said in his presidential address before the Pacific division of the American Association for the Advancement of Science at Claremont, Calif., on June 13.

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.

CHEMICAL BONDS AND LIGHT WAVES

THE chemical bonds between particular kinds of atoms are tuned precisely with certain wave-lengths of light, according to recent discoveries of Dr. Joseph W. Ellis, physicist in the University of California. Instead of co-operating with the light radiation, however, these chemical attachments nullify or absorb the special light waves to which they are attuned. Dr. Ellis thus identifies the bonds by noting the kind of light which does not get through the substance he is investigating.

For decades chemists have been able to tell what elements are present in a substance, and in most cases how many atoms of each. The pattern by which the atoms are tied together in compounds, however, is known or guessed only on circumstantial evidence. Nevertheless the pattern is all-important. Dr. Ellis' experiments show which atoms are directly bonded together.

Chemists would gladly accomplish all this by magnification and direct photography of the molecular structure. Unfortunately this is impossible with atoms only one two hundred millionth of an inch in diameter, and light waves five thousand times as wide.

By the new methods infra-red, or low frequency, rays are passed through simple chemical compounds like aniline, alcohol, etc., whose structure is already known and undisputed. Accurate measurement is made at the odd places in the spectrum where a stoppage of light is caused by particular chemical bonds. Dr. Ellis is able to specify with high numerical accuracy just what wave-length, or color of light will be absorbed if a substance under examination contains, for example, a nitrogen atom attached to a hydrogen atom. Nitrogen and hydrogen atoms scattered about in other relations and tied to other atoms give no such response. Similar data have been obtained for the carbon-hydrogen and sulfur-hydrogen bonds. Many additions to the list are expected with further research.

By combining a spectrograph and camera with electrical accessories, the physicist simply tests his substance down the gamut of the spectrum from blue to infra-red. Each chemical bond automatically records its presence by a dent in the photographic line record. Just as a piano wire may respond to sounds in more than one octave, so the chemical bonds give over-tone records which confirm the proof desired.

Even greater value may lie in the possibility of calculating the strength of a chemical bond. Dr. Ellis is enabled through mathematical physics to show how firmly a substance is bonded on a basis of the wave-length chosen. From such a computation it may be possible to predict in some degree the possibility of some desirable chemical reaction taking place.

EMISSION OF RAYS BY PLANT CELLS

THE latest sensation in scientific circles in Berlin is the discovery that the apex of certain rapidly growing vegetable and animal tissues emit some sort of invisible radiation which has the power to stimulate the growth of living matter with which it is not in contact. When this was first announced in 1924 by Professor Alexander Gurwitch, of Moscow, it was received with considerable

skepticism here, but now it has been confirmed by German investigators who are eagerly prospecting the new field of research in various directions.

Gurwitch found that if the tip of one of the rootlets of an onion or turnip was fixed so as to point at right angles to the side of another root, though as much as a quarter of an inch away, the cells in the side nearest the tip would multiply more rapidly than elsewhere and so bend the root away. That this influence was not due to the emission of some gaseous emanation from the root tip was proved by the interposition of a thin sheet between the two roots. Glass and gelatin sheets stopped the transmission of the growth stimulation power but quartz did not. This is characteristic of ultra-violet rays and Gurwitch concludes that the radiation from the root tips has a wave-length of 180–200 millimicrons, which would place it among the ultra-violet rays of high frequency.

The German botanist, N. Wagner, has repeated these experiments with bean and onion roots and measured the effect by counting under a microscope the number of new cells produced in the roots acted upon. The increase is as high as 70 per cent. in some cases. Old cells that have ceased growing show the greatest relative increase.

The German bacteriologist, M. A. Baron, has found that the radiation from onion roots will likewise accelerate the growth of anthrax bacillus and other bacteria. The growing tip of toadstools gives off these same growth-generating (mitogenetic) rays.

The Siemens Electrical Company has taken up the question and Doctors Hauser and Vahle working in these laboratories report that certain growing animal tissue, such as cancer, emit such rays.

These results, if confirmed, will radically revolutionize present theories of life and growth. It has hitherto been assumed that the impulse to cell subdivision was somehow due to the direct contact of certain chemical substances transmitted through the tissues, but it now seems that an energy agency is active in vital processes, an immaterial radiation of the nature of light but of too high a frequency to be detected by our eyes.

PUBLIC HEALTH AND THE PHYSICIAN

CARE of the public health is the particular province and special responsibility of the physician, said Dr. William Sidney Thayer, of Baltimore, new president of the American Medical Association, in his inaugural address on June 13 at the annual meeting of the association in Minneapolis.

"In the first place we should use every means in our power to maintain the character of our public health officials," said Dr. Thayer. "Conditions have changed for the better but we are still treated too often to the humiliating spectacle of a mayor who appoints his family physician or some friend who has tired of practice to the position of commissioner of health."

Speaking to the 6,000 physicians who have assembled here, representing the organized medical profession of the country, Dr. Thayer reminded them of the object of their association as stated in its constitution: ". . . to promote the science and art of medicine and the betterment of public health." It is this altruistic attitude that marks the difference between medicine or any other profession and trade which has financial gain as its primary object. The true physician will not forget this difference and while he must earn a living, "if his main interest be not in his profession or if financial gain be his sole object, he will accomplish little and his name will be soon forgotten."

Of a physician's functions, the first, and most obvious, according to Dr. Thayer, is the individual care of his patients, after which comes prevention of epidemics, which requires attention to every detail involved in the spread of disease including cooperation with local boards of health by reporting communicable diseases, enforcing quarantine regulations, etc.

"Too early specialization is one of the great faults of modern American education," declared Dr. Thayer, speaking of the future of medical education. "The medical school is not the place for the training of specialists . . . the specialist who has not had a good basic medical training is a danger to society." Dr. Thayer also voiced the feeling current in many medical schools to-day that too much is being crowded into the four years' course. In this connection Dr. Thayer expressed the hope that "such elementary methods as a prescribed four years' course" will disappear from our medical education, schools of medicine in the future will be organized so that the student will be treated as a man and not as a schoolboy.

SENSITIVITY TO SUNBURN

WHETHER or not you sunburn easily may now be tested in a doctor's office, without going to the seashore. At the meeting of the American Physical Society in Claremont, Calif., on June 15, 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 any one 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 sunburning, 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."

TREE GROWTH AND THE WEATHER

A NEW theory regarding the period of greatest growth of California's big trees, or *Sequoia gigantea*, has recently been advanced by Walter Fry, commissioner for Sequoia National Park and for 40 years a student of natural conditions in the big tree park area.

Most scientific men have for years held the theory that the greatest growth of the trees was made in wet years or the years of the most snow. Judge Fry disagrees with this, contending that the Sequoia makes its greatest growth during dry seasons, and its least growth when the ground is covered with snow until late in June. Superintendent White, of Sequoia National Park, agrees with this latter theory.

The growing season of the Sequoia, occurring at elevations varying from 5,000 to 8,000 feet, is necessarily short. The judge points out that the big trees do not begin to bud until the snow has disappeared and the sun begins to warm the ground. In years when the snow remains late on the ground the growth of the trees is retarded, while in winters of light snowfall the ground is free of snow early and the trees have a longer growing season and the rings therefore have a greater growth in the dry years.

Judge Fry, to prove this contention, has counted the annual rings on a large number of down trees. The largest of all that he has counted, a fallen monarch of the Converse Basin near the park, has 3,226 annual rings. According to the judge a study of this tree shows that it had its fastest growth in the years between 400 and 250 B. C., and its smallest growth in the years between 650 and 800 A. D.

His years of investigation and study among the big trees lead the judge to believe that the climate of that portion of California in which they thrive has remained practically the same throughout the life of the Sequoias, although 1923–24 appear to have been the dryest years known to man.

ITEMS

FOUR Antarctic sea elephants, among the rarest of all large animals, have been brought to Hamburg by the great animal-importing firm of Carl Hagenbeck Company. At the present time no European zoo can boast the possession of a specimen. Other importations from the Antarctic include 25 king penguins and 35 gold-crested penguins. South America has contributed two very rare animals, the maned dog and Magellan's wolf, in addition to better-known creatures such as tapirs, ant-bears and jaguars. From Africa a new subspecies of chacma, a kind of baboon, has been brought for the first time.

A PROCESS for getting oil out of steam condensation water has been developed by Fritz Hoyer, a German scientist. It is expected to replace the mechanical methods for removing the troublesome residue of oil now in use. Most of the oil which is used for lubricating steam pistons and gearing is atomized and carried away in the waste steam. As a result of this a very stable milky emulsion is formed on the condensed water, and the problem of separation of oil and water is an extremely difficult one. In the Hoyer process a direct current is passed through the water, which collects the oil in small foam flakes, thus destroying the emulsion and making filtration possible. The consumption of electricity is about one kilowatt hour for five cubic meters of water.

THE relationship between lack of sufficient food and tuberculosis has been definitely proved by Dr. Harry Schutze and Dr. S. S. Zilva, of the Lister Institute. In their experiments with tuberculosis in guinea-pigs during the last six years they have found that diet is a very important factor. They divided their animals into two sets; one set was given a complete normal diet, with abundance of food, and the other set had a similar diet but restricted in amount. The guinea-pigs on the restricted diet did not put on weight, whereas the others did. After two and one half months of dieting, all the animals were inoculated with a living culture of tubercle bacilli, in order to test their resistance. In each case the animals on the abundant diet lived twice as long as those on the restricted diet.

WHILE to-day walruses are practically confined to the little-visited Arctic seas, within historic times they have been common as far south as the Gulf of St. Lawrence, and the recent finding of a skull on Georges Bank, off the coast of Massachusetts, seems to indicate that these mammals did come down as far south as northern United States waters perhaps no longer than two or three hundred years ago. This interesting specimen, consisting of the fore part of a walrus skull with the tusks still in place, was recently dredged up by the steam trawler *Mariner* at a depth of eighty fathoms. Colonel J. M. Andrews has turned the skull over to the Boston Society of Natural History.