# SCIENCE NEWS

*Science Service, Washington, D. C.*

## PROBLEMS OF OCEANOGRAPHY

ALL the creatures man takes from the sea to eat or use, from whales down to shrimps, depend for their life and growth on the behavior of the water, and that in turn depends on such seemingly remote factors as the shining of the sun, the ice of Antarctica, the flow of tropical rivers and the height and length of submerged mountain chains. At the Pasadena meeting of the American Association for the Advancement of Science, Dr. T. Wayland Vaughan, director of the Scripps Institution of Oceanography, outlined the problems confronting investigators in their endeavor to obtain a scientifically and economically useful panoramic view of oceanic life.

The distribution of most of the things needed by plants and animals in the sea depends largely on the circulation of the water, bringing new supplies of mineral nutrients and oxygen up from the uninhabited depths to replace the depleted supplies in the more densely populated surface layers and inshore zones. Circulation in the ocean is influenced by a number of factors, but its primary cause is the same as that of the air circulation that makes weather: the heat of the sun, warming some parts of the earth more than others.

If the ocean covered the whole earth to a uniform depth, Dr. Vaughan said, the surface circulation would be from the warmed equator toward the cold poles, with a return circuit of cold water along the bottom, rising to the surface again at the equator. But actual conditions on the real earth modify this behavior of the "ideal ocean" very greatly. The long north-south stretches of the continental masses get in the way and the rotation of the earth deflects the currents from a true north-and-south line. Continental masses, island chains and submarine ridges get in the way, hindering currents or blocking their most natural courses altogether. Prevailing winds hasten surface currents that flow in the same direction and hinder currents flowing against them. Rainfall, whether directly into the ocean or running off the land as rivers, dilutes the water and makes it lighter; evaporation increases the salt concentration and makes it heavier, so that it tends to sink even if warm. All these different factors working at the same time make the circulation of the world's ocean system a very complicated matter, of which scientists are at present getting only a preliminary notion. Years of intensive study, with the most elaborate equipment on special ships, are still needed.

## X-RAYS MOST DESTRUCTIVE TO GROWING CELLS

X-RAYS in sufficient doses are destructive to all kinds of living cells, but they are most destructive to cells that are physiologically young and active. This is one of the basic physiological facts that underlie radiotherapy, according to Dr. Arthur U. Desjardins, of the Mayo Clinic, who spoke at Pasadena. It follows from this principle that tissues that remain "chronically young" respond to X-ray dosages much smaller than those needed for effect on maturer tissues.

The most sensitive of all the cells in the human body are certain classes of white blood corpuscles, and the glands and other tissue masses where these are found most thickly are also very sensitive to the destructive rays. Dr. Desjardins inclines to the opinion that the easy destructibility of these white blood cells is at the bottom of the value of X-ray therapy in certain inflammatory conditions. White blood corpuscles crowd around foci of infection, causing inflammation. The X-rays break them down, releasing the germ-destroying substances they have formed within themselves, and thereby hasten the death of the trouble-causing bacteria.

Certain kinds of tumors and cancers can be treated with X-rays because the cells consituting them are physiologically younger than the surrounding tissues. The diseased growths are therefore destroyed by doses of X-rays that do no appreciable harm to the healthy tissues.

The most sensitive of normal body tissues are the mucous surfaces lining the digestive and certain other cavities. Muscle, bone and nerve tissues are among the most resistant.

## SUPER X-RAYS IN THE TREATMENT OF CANCER

DOUBT that the new high voltage X-ray tubes now being developed by physics will effect any great revolution in the treatment of cancer was expressed by Professor R. R. Newell, of the Stanford University School of Medicine, at a symposium given at the meeting of the American Association.

"I do not think," said Professor Newell, "that radium and X-rays will ever prove the solution of the cancer problem. I think the solution must await the discovery of what cancer really is."

Roentgen rays produced at higher voltages will soon become available for clinical use. This means shorter wave-lengths and hence greater penetration. It will be more like radium radiations and of great intensity. Many workers feel that radium produces better results in cancer than do X-rays. Professor Newell pointed out that radium is usually used on smaller masses of tissue and often at a much higher tissue dosage than X-rays.

As we go to shorter wave-lengths, scattering becomes relatively more and more important, so that there comes continually poorer reward for the further increases in voltage. The biologic effect of X-ray has as a first step the acceleration of electrons. These are faster and have a longer path the shorter the X-ray wave-length. Present X-ray tubes provide electrons of such speed that they can not give up all their energy within a single cancer cell. It is hard to see how faster electrons from

shorter wave-lengths can give any improvement in biologic effect.

The amount of energy in an X-ray treatment is very small. The high-speed electrons produced within the body might number a thousand for every cell. But not all parts of the cell are vulnerable. Several shots must take effect on the vulnerable spots of a single cell before that cell is killed. The chances are that a few cells will escape in this lethal lottery even after very large doses.

## SPIROCHETES TO COMBAT PARESIS

PARESIS, now combated in some cases by inoculating the patient with malaria germs, will be subjected to a new attack along a somewhat similar line, but with a harmless relative of the syphilis germ substituted for the malaria organism which sometimes causes considerable suffering and even occasionally death while it casts out the original disease.

At the meeting of the Association on June 16, Dr. Frederick Eberson and William G. Mossman, both of Mount Zion Hospital, San Francisco, told how they have succeeded in growing artificially a harmless spirochete capable of causing a temporary but self-curing fever that operates against paresis much as malaria now does. The syphilis germ, basic cause of paresis, is also a spirochete, so the new treatment is a case of setting cousin against cousin.

The new germ was discovered in ticks in North Africa, and has been used in fever therapy there. However, the technique used in Africa by European doctors has involved the inoculation of guinea-pigs with the germs taken from the ticks, and then the injection of blood from the guinea-pigs into the patients. The method developed in San Francisco eliminates the time loss and uncertainty introduced by the use of guinea-pigs. A very small amount of the pure laboratory culture of spirochetes is used directly on the patients. About a week later they develop a strong fever, which runs its course in about seven days. No medication is necessary to stop it, as is the case with malaria. The fever is self-limiting, and it can be provoked anew by re-inoculation as often as is necessary for the benefit of the patient.

Growing the germs in glass vessels in the laboratory also simplifies the hospital's problem of keeping a supply on hand for treatment. Malaria germs have to be obtained from malaria patients, or from blood samples drawn from paresis patients undergoing malaria fever treatment, and such blood samples of course always run the grave chance of carrying fresh syphilitic or other infection with them. But with the spirochetes growing in glass tubes or flasks, and keeping in usable condition for several months in an incubator, the hospital physician is independent of a living source for the germs of the beneficent fevers he desires to use.

## FOCUSING OF HEAT RAYS

A COPPER burning mirror which reflects to a focus the rays from an electric arc instead of from the sun has been perfected at the Metallographic Institute, in Stockholm, by Professor C. A. F. Benedicks and Dr. J. Harden. Temperatures of over 3,600 degrees Fahrenheit have been obtained with its aid.

An electric arc between poles of carbon, carrying up to 100 amperes of current, is fixed at one focus of an elliptical mirror 17 inches in diameter, and the heat and light rays are concentrated at another point some distance away. A high temperature can thus be made at this second focus.

Rapid heating and freedom from admixture with foreign substances are advantages of this method of producing high temperatures. A piece of platinum, which requires a temperature of 3,250 degrees centigrade to melt it, was reduced to the molten condition in four and a half minutes. About 25 per cent. of the energy put into the arc is effective in producing the hot spot.

Mirrors have been used to produce high temperatures from the sun's rays throughout history. There is, however, a natural limit to the heating power of such a device, since a mirror of given size can only pick up a certain definite amount of the sun's rays.

Solar furnaces of this kind using parabolic reflectors have recently been perfected at Jena, Germany, by Professor Rudolf Straubel, of the Zeiss Optical Works, and at the new astrophysical laboratory of the California Institute of Technology. Carbon, one of the most refractory of all substances, has been melted in these furnaces at a heat of 5,400 degrees Fahrenheit.

## ULTRA-VIOLET LIGHT IN ANTARCTICA

ULTRA-VIOLET light observed on the Antarctic continent by members of the Byrd expedition is very similar in nature to that observed in Washington. The photographs on which this conclusion is based were made at the bottom of the world by Mr. Malcolm P. Hanson, and the findings have been announced jointly by him and Dr. E. O. Hulburt, of the U. S. Naval Research Laboratory.

The rainbows formed by the light of both the sun and also of the moon during the long night of the Antarctic, were measured and found to contain practically the same range of colors. These spectra are of importance to science as indicating that the quantity of ozone in the upper atmosphere does not change with the seasons and is much the same in different parts of the world. The comparison spectra were made with similar equipment by the Naval Research Laboratory in Washington.

The short-wave limit in the ultra-violet of the spectrum was found to be much the same in November and January in Little America as it was in December or January in Washington.

The penetration of the shortest light waves is prevented by the presence of small amounts of ozone, a form of oxygen, in the upper atmosphere. The amount of this gas is astonishingly small in view of its importance for protecting mankind from too severe sunburn. The thickness of the ozone layer that keeps back the shorter waves from penetrating the atmosphere would be only about one eighth of an inch if brought down to the surface of the earth.

The moon spectra were taken in April and July by the expedition, both observations being made during the Antarctic winter night. The spectrograph was mounted outside on the snow, aimed at the moon and shifted by hand from time to time.

## WIND EFFECT ON TREES IMITATED IN LABORATORY

To determine the effect of wind strain on the growth of trees, Dr. W. S. Cooper, of the University of Minnesota department of botany, is carrying on an experiment with Monterey cypress trees. These cypress trees, which have always proved of interest to tourists because of their fantastic shapes, grow native on the rocky coast of California, and are constantly exposed to the wind from the ocean.

How does wind effect the growth of the woody structure of these trees? The natural assumption is that any tree puts on wood in the plane of the wind strain to support itself.

In this experiment, Dr. Cooper has placed thirty-five young Monterey cypress trees in large flower pots. A sliding frame is attached to the trunks of the trees. This is driven by a small motor. The motor causes the frame to slide back and forth, and this makes the trees sway as if in the wind. At the point of contact of the frame and the tree, a rubber insulation is placed to protect the wood from injury. In this manner the trees have swayed nine hours every day for three years.

The results have been contrary to the natural assumption. Dr. Cooper found that until recently, the trees were adding wood and getting thicker at right angles to the strain instead of along the plane of wind pressure. However, in the past few months, a slight change has been taking place. There is evidence to show that in the trunk of each tree, above the point of contact with the frame, the wood is becoming thicker in the plane of the wind strain as was originally expected.

A similar experiment was carried on by G. P. Burns, of the University of Vermont, several years ago. He used white pine trees, however, and conducted the experiment for one year only. His results were the same as Dr. Cooper's in that the trees put on wood at right angles to the strain during that one year.

Dr. Cooper expects to continue his work another two years.

## HOW BEARS CAN LEARN

BEARS caught robbing the traps at the Yellowstone fish hatchery recently were "given the works" but not to a fatal degree. It happened this way, according to the park naturalist, Mr. Alfred H. Povah. The traps, placed at the most advantageous spots in a number of creeks, were supposed to catch quantities of fish ready to spawn, and thus supply eggs for restocking purposes. Plenty of fish were seen in the creeks on their way to these spawning grounds, but the traps remained empty. The fish culturists, acting as piscatorial detectives, solved the mystery. Through a few scattered eggs lying along the bottom of the creek just below the trap, they deduced the fact that bears were robbing the traps, and decided to administer an unforgettable lesson.

These traps were inclosed in a fence of wire screening about three feet high. Inside this and about one inch away from it, the hatchery men strung a single strand of heavy copper wire. This was connected with two large storage batteries, hidden in a nearby box, in such a way that when the wire screening was pushed against the copper wire an electric contact was made. The fact that the bear depredator had to stand in water to reach the trap assured a "ground" for the electric current through the animal. This current, while not strong enough to injure the bears, gave them a most unpleasant shock and acted as a positive deterrent against further fish forays.

There was no witness to the chagrin of the first bear to encounter the wire, but within a week after the shocking apparatus was installed the trap was full of fish—and there will now be plenty of eggs for restocking the park's lakes and streams.

## ITEMS

THE Kenya Agricultural Department reports that locusts are hatching over an area of seven million acres in the Kenya district of East Africa alone. In addition to this the laying of locust eggs is proceeding over hundreds of miles of dense tropical vegetation in Uganda. The town of Masindi was recently inundated by locusts, forcing all shops to close. In the Kenya district the Agricultural Department is effectively combating the locusts, twelve hundred bags of poisoned bait being issued daily, while there is also spraying and trench trapping. In the Uganda district there is no adequate policy of destruction and great fears are expressed by the neighboring districts regarding the damages anticipated when the eggs mature.

THE appearance of eight pairs of trumpeter swans was reported in Yellowstone National Park during the month of May, which is their nesting period. Conservationists hail this as good news, for these birds are one of the species which are facing extinction under changing conditions, and the Yellowstone is one of the points where it is hoped to check the apparently ebbing tide. Unless the few remaining trumpeter swans in existence can nest and rear their young safely, the species will soon join the dodo and the passenger pigeon.

X-RAYS have been produced by a new method which does not require the use of the usual X-ray tube, by M. G. Reboul, of the Physics Laboratory, Montpellier. The X-rays are produced when electric currents are driven through solids of high electrical resistance with the help of high electrical pressures. In materials that conduct the electric current badly, like the magnesia, alum and yellow oxide of mercury used in these experiments, most of the voltage used is taken up in driving the current across one end of the specimen. At this point where the large fall of voltage occurs, X-rays of low penetration are produced. X-ray photographs of the usual type have been obtained with this arrangement which is simpler than the usual type of apparatus.