

MARINE BIOLOGY

Red Tide Mystery

When water conditions are exactly right, a tiny, one-celled, plant-like organism multiplies enormously, producing a fish-killing poison whose chemistry is not yet known.

By DR. HAROLD J. HUMM

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► THE RED tide is not a tide and it is not really red. It is a term applied to an extremely abundant development of a tiny, one-celled, plant-like organism which secretes a poisonous substance into the water. Most scientists believe this organism is present, but relatively rare, in the waters of the Florida Gulf coast at all times.

But most of the time there are too few to have a harmful effect upon fish and other animals. Once in a great while water conditions reach a certain state that promotes the development of enormous numbers of these tiny organisms, and when this happens, the poison they produce becomes concentrated enough to kill.

The organism belongs to a group that is neither plant nor animal, but is intermediate in nature. However, it possesses chlorophyll as do true plants. Marine scientists classify it as a dinoflagellate, *Gymnodinium brevis*. It was first described by Dr. C. C. Davis of Western Reserve University, Cleveland, who studied it during the 1946-47 outbreak.

During autumn, water conditions off the lower west coast of Florida occasionally reach a certain, precise state that promotes the rapid development of *Gymnodinium brevis* that results in enormous numbers forming patches in the water, in which there may be 50 to 75 million per quart of water.

The water at first develops a yellowish hue which darkens to an amber color with a reddish tinge as the organisms increase. At the same time the water becomes remarkably thick and stringy.

Poison's Nature Unknown

While the conditions that promote the development of this organism in such numbers are not known, it is believed that rivers which drain phosphate-rich land of southwest Florida may be an important factor in view of the phosphates they contribute to the Gulf in the red tide area.

The chemical nature of the poison that red tide organisms secrete into the water is not yet known. It is believed to be a nerve poison. Fish are not killed by clogging of the gills or lack of oxygen. If asphyxiation is the cause of death, it is a result of the effect of the poison upon the nervous system and not because of mechanical interference with circulation of water through the gills.

The poisonous substance affects many other marine animals as well as fish. Invertebrates including barnacles, oysters, clams, shrimp and crabs are killed. There are reports that porpoises and sea turtles are also killed.

Toxicity of the water to man is shown by the nose and throat irritations that take place when an off-the-sea breeze prevails that exceeds 14 miles per hour. Under these conditions, droplets of red tide water are blown into the air and inhaled by persons ashore. While the irritation produced is not serious, its cause is clear.

Sea water from which the red tide organisms were strained was just as toxic to fish as water containing the organisms. It was by this procedure that scientists proved that the organisms excrete a poisonous substance into the water.

Despite the large numbers of fish killed, an estimated half billion during the 1946-47 red tide period, there is no acceptable evidence that a significant proportion of the population is killed to make a detectable reduction in the population of the affected area. It appears that the "loss of enormous numbers of game and food fish" is of no direct economic importance.

Discourages Tourist Trade

There is an economic loss, however, by the fact that tourists, Florida's major "industry," are driven away from the beaches while dead fish are washing ashore or decaying.

In addition, the fishing industry suffers a loss because the demand for fish may be reduced during the red-tide period, and fishing may be curtailed. During the current red-tide development, winds have driven the dead fish out to sea. During November, at least, not enough fish washed ashore to affect normal use of the beaches.

Authentic reports of the red tide along the Florida Gulf coast are on record for more than 100 years. It is probable that the same organism has been responsible for almost every outbreak. On the average, the red tide has occurred once each decade but its appearance is very irregular and unpredictable.

Phenomena similar to the red tide are known all over the world. In California, one form of it is annual and renders the sea mussels inedible each summer. Probably the majority of red-tide phenomena which have been studied has been caused by an organism belonging to the dinoflagellates.

Mariners in the past have often mistaken

discolored water for a shoal, which they reported to the hydrographic office as a menace to navigation, since it did not show on the chart.

The Florida red tide, if it behaves as before, may reappear during the winter. If this takes place, a thorough understanding of it should result, in view of the teams of scientists who are now in position to study it from every aspect.

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BIOCHEMISTRY

B Vitamins Play Role In Making Antibodies

► CERTAIN B vitamins play a significant role in the synthesis within the body of antibodies, the substances that help fight disease germs. The particular B vitamins for which such a role has been found are pyridoxine, pantothenic acid and pteroylglutamic acid.

Do not, however, rush out to buy a box of these vitamin pills with the idea of building up resistance to colds, influenza and the like.

How the findings are related to the general problem of nutrition and resistance or susceptibility to infection is not yet clear, Dr. A. E. Axelrod of Western Reserve University points out in reviewing his own studies and those of other scientists.

The problem will be cleared up, he says, when scientists show that the immune response to an infectious agent, or disease germ, is markedly affected in a given vitamin deficiency state, and that this change in immune response is a vital factor in determining the resistance and susceptibility to the infection.

Vitamin antagonists, Dr. Axelrod suggests, might also be used to check the undesirable synthesis of antibodies, for example, those to the Rh blood factor.

Whether or not scientists ever reach the stage of saying a certain vitamin should be prescribed to build resistance to a particular disease germ, the ability to control antibody production in experimental animals by the vitamin intake should, Dr. Axelrod states, "be a useful tool in the unraveling of the mechanisms of antibody synthesis."

Dr. Axelrod's comments on the vitamin-antibody relationship appear in *Nutrition Reviews* (Dec.).

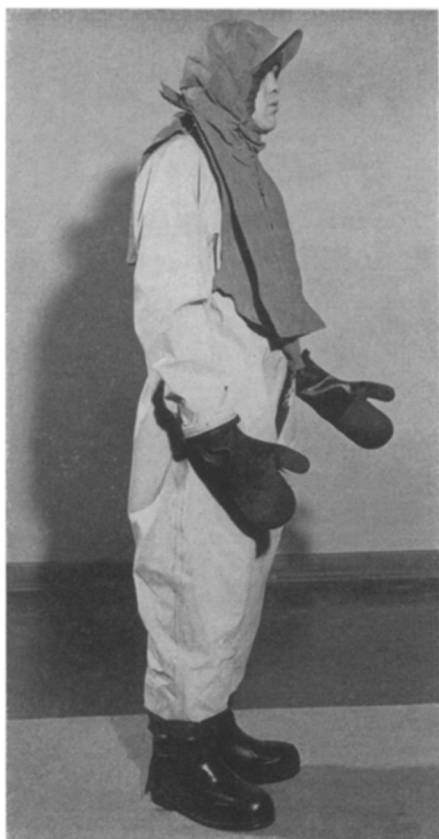
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TECHNOLOGY

Floating Coverall For Submariners

► THE NAVY has developed a brand new kind of coverall with built-in water wings to protect submarine personnel should they be swept overboard into churning seas.

The coveralls will be particularly useful on subs equipped with snorkel tubes. Because of their streamlined design, surfaced snorkel-type subs do not offer their crews as much protection on deck as older types do.



EXPOSURE SUIT—For submariners swept overboard at sea, the Navy has developed a new kind of coverall to protect the sailors from exposure.

Made of neoprene-coated nylon, the coveralls have detachable boots and mittens. That permits small men with big feet to be fitted as easily as tall men with small feet. The mittens can be left off or worn, depending upon the work being done by the sailor.

Should he be carried overboard by a wave, the sailor can inflate his water wings by pulling a cord that releases carbon dioxide into the life vest. With boots and mittens on, the sailor can stay afloat in the ocean without getting wet.

The rubber boots, actually the forerunner of those now being worn by servicemen in Korea, have a steel ring imbedded in their tops. An expandable rubber cuff attached to the trouser leg of the coveralls stretches over the boot's ring, providing a watertight seal. The same arrangement is used to seal on the mittens.

About 500 test suits already have been tried out in the Atlantic and the Pacific. T. J. Seery, head of the clothing research development section of the Navy's Bureau of Supplies and Accounts, reported that the coveralls were received enthusiastically. Clothing specialists now are working on what they believe is the "final model." The coveralls soon should be standard equipment for all submarines, Mr. Seery suggested.

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ASTRONOMY

Universe Found Heavier

► THE WEIGHT of the universe has been underestimated. It weighs almost ten times as much as previously believed, according to estimates just reported by Dr. Thornton Page of the Operations Research Office of Johns Hopkins University, Chevy Chase, Md.

The average galaxy of stars is about as massive as 80 trillion suns, Dr. Page figures. His measurements were made with the 82-inch reflecting telescope of McDonald Observatory in Texas while on the staff of the University of Chicago.

The universe is very widely spread, however. On the average, there is only about one pound of the cosmic material of which stars are made in the space occupied by 40,000 earths, the astronomer calculates.

Double galaxies provide the best means that are presently available for determining

the mean density of the universe, Dr. Page believes.

Just as the masses of double stars can be approximated, so can the average mass of double systems of spiral nebulae be estimated by measuring their distance apart and the speed with which these huge aggregations of stars swing around each other.

There are many heavyweight and many lightweight galaxies in the universe, but few with masses in between, if the 40 pairs of galaxies studied are typical of double systems throughout the universe. The lightweight systems weigh about five trillion times as much as our sun, the equally numerous heavy ones average 150 trillion times the sun's mass, Dr. Page reports in the latest issue of the *Astrophysical Journal* (July).

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MEDICINE

Water-Logging Stopped

► WHEN HUMAN bodies become waterlogged because of congestive heart failure, cirrhosis of the liver or high blood pressure without known cause, synthetic resins can relieve the condition.

The resins are chemically related to plexiglass and similar to those used in water softeners. The patient swallows them in the form of a finely ground powder stirred in water or fruit juice.

Successful use of this treatment was reported by Dr. B. L. Martz of the Indianapolis General Hospital, Indianapolis, at the meeting of the American Medical Association in Denver.

The water-logged condition in heart and liver patients, he explained, comes because the body cannot eliminate sodium, a mineral in table salt and many foods. Rigidly low sodium, or salt, diets plus injections three or more times a week of mercurial compounds have been necessary to remove the excess water and sodium from the bodies of such patients.

The new resins eliminate or greatly decrease the need for the mercurial injections and allow the patient a more palatable diet.

Dr. Martz reported good results in the resin treatment of 50 patients with congestive heart failure, and in all but one of 18 patients with ascites, or fluid accumulation, due to cirrhosis of the liver.

Of 18 patients with high blood pressure, eight were brought to normal by restriction of sodium and the use of resin. In five more cases the blood pressure was reduced significantly. The other five failed to respond.

Because of the relatively large bulk of material that had to be swallowed in this form of treatment, there were some cases

of mild or marked gastrointestinal disturbances. Side-effects prevented continuance of treatment in eight.

Drs. K. G. Kohlstaedt, O. M. Helmer and R. S. Griffith, all of Indianapolis, cooperated with Dr. Martz in the study.

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TECHNOLOGY

Radioactive Tracers Mark Pipe-Line Oil

► OIL COMPANIES now are using radioactive materials to label different kinds of oil routed through the same pipe-line to various points along the pipe-line's length.

Dr. Paul C. Aebersold of the Atomic Energy Commission reported to the American Management Association that oil wastes can be cut by the new technique.

Since a pipe-line may be used to carry many different kinds of oil, it is difficult to get "clean separation" at the point where one batch of oil ends and a different grade begins. By putting radioactive materials into the line just before changing the grade, engineers have provided themselves with an effective label.

Geiger counters trace the radioactive material as it moves through the line. When it gets to the terminal scheduled to receive the grade of oil following it, terminal operators detect the radiation and draw off only the oil they are supposed to receive.

One company already is using the method to label oil flowing through its 550-mile pipe-line from Salt Lake City to Pasco, Wash.

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