

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.

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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.