cluded from any science classroom in which this type of instruction is given if their parents so indicate. They are thereby deprived of instruction in well-established scientific truths, which are deemed educationally essential from the point of view of personality adjustment and citizenship in modern society. For example, should not every citizen know that many of our most important diseases are caused by microorganisms; that they are controlled by bacteriological methods, such as vaccination, sanitation, etc.? Can we expect citizens uninformed of these well-established scientific facts to act intelligently in safeguarding the health interests of society? It is our contention that an educational system that fails to give every citizen this instruction is derelict in its duty both to the individual and to society.

Not only will these children be improperly deprived of instruction but, inevitably and more important, *all* children will ultimately be deprived, because the Commissioner of Education directs that

> *A.* Local school authorities are advised to evaluate achievement for pupil credit purposes in such manner as not to penalize pupils who have been excused from the specified units of study.
> *B.* Required sections of the Regents examination as well as the State Scholarship examinations will be constructed so as not to penalize pupils who have been excused from instruction in the specified units of study [Quoted from directive of Commissioner of Education, August 11, 1950].

New York State syllabi are, as a rule, constructed with a view to satisfying the requirements of the State Board of Regents. It is only a short step from the elimination of subject matter from the required part of the regents' examination to the complete elimination of this same subject matter from an already crowded curriculum. It is only another short step to the elimination of this unit of work from textbooks, too, since textbooks are written to meet the needs of the course of study. Thus, we can foresee a situation in which all children are deprived of the opportunity of learning the well-established scientific facts about health.

Even our superior students, our future doctors, teachers, dentists, physicists, chemists, will suffer the same deprivation, since they will omit the study of communicable disease from their preparation for the New York State Scholarship Examinations.

Although the immediate situation is serious enough, a more serious problem for science teaching is in the offing. How long will it be before the officials of other religious groups start to scrutinize the facts taught in science classrooms with an eye to petitioning for the exclusion of "the flock" from instruction in those facts that conflict with their tenets? Since the Commissioner of Education is practically bound by the law to grant such petitions, it is possible to foresee a time when our science curricula will be demolished piecemeal. In essence, this is a form of censorship whereby the various religious groups exercise control over what goes into the curriculum by determining what is to be excluded. Not only do we as science teachers find this form of censorship abhorrent, but we maintain that it is directly contrary to the traditional democratic principle of separation of church and state.

Where scientific laws are established beyond a doubt (with enormously high probabilities), should conflict between such laws and the tenets of religious groups be officially recognized by secular educational authorities or by legislative bodies? What makes a religious tenet? Is it any belief, no matter how fantastic, so long as it is held by a religious group?

Do the interests of society ever make it necessary to ignore the tenets of a religious group for the benefit of the overwhelming majority?

We urge this law of the New York State legislature as required reading for all groups interested in science and in science teaching. We urge such groups to weigh the consequences of this kind of legislation and to take action now. This means educating public opinion and taking political action. In addition, in New York State it means that we must work for speedy repeal.

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Mass Mortality and Dinoflagellate Blooms in the Gulf of Mexico

OBSERVATIONS made by Lund (*1*) showed striking parallels between mass mortality of fishes along the Texas coast in 1935 and the "Red Tide" of Florida in 1946, which was caused by dinoflagellate bloom (*2*). Since then there have been two other suspected episodes in Texas. Recently Connell and Cross (*3*) have brought together many diverse observations on the association of fish mortality and *Gonyaulax* bloom in Offatts Bayou, a small branch of Galveston Bay. Some of the facts presented merit further discussion.

The authors say that when Cabeza de Vaca visited the Texas coast in 1528 he listed a season as the "time when fish die." They leave the inference that this could have been caused by a phenomenon similar to the Red Tide. It should be noted that only a widespread mass mortality would have received the attention of this early explorer, who was traveling under the most difficult conditions, part of the time as a slave to the Indians. Widespread mortalities caused by dinoflagellate blooms are not annual characteristics of the Texas coast. The words of Cabeza de Vaca have been noted before and related to oversalinity of the Laguna Madre and to the effect of the cold "northers" on the shallow bays of the Texas coast. The latter are more widespread and more seasonal phenomena, and it is much more probable that Cabeza de Vaca had the seasonal cold spells in mind.

Offatts Bayou is unique as a small locality with recurring summer mortalities of marine organisms.

There is nothing similar elsewhere on the Texas coast. Furthermore, it is largely artificial, having been dredged out several years ago. It is widest and deepest near the blind inner end, and the restricted mouth deters circulation. On the whole it is relatively stagnant. Salinity data showing poor circulation have previously been presented (*4*).

Connell and Cross (*3*) say that the red water was caused by *Gonyaulax* in Offatts Bayou, but that it did not cause immediate mortality, which only followed when the *Gonyaulax* "settled." They apparently believe that death of the indigenous fauna of these waters was caused by a lowering of the oxygen content by vast concentrations of *Gonyaulax,* followed by extensive anaerobic conditions and putrefaction. They also add that the virulent poison of *G. catellana,* which their species resembles, has little effect on fish. This point is questionable. A simple experiment (*4*) showed that *Gymnodinium* does kill fish in well-aerated aquaria. The organisms were present at the relatively dilute concentration of 270,000/liter.

The writer saw red water in Offatts Bayou in 1940 and 1941. It drained from a disposal pipe of a large meat-packing plant on shore and was not distributed very far away from this plant. Red water, among other colors, was also reported at times in the "boils," which were areas up to 30 ft in diameter "boiling" furiously with escaping gas. The color could have been caused by *Gonyaulax.*

The presence of *Gonyaulax* does not explain the "boils," which evidently came up from the bottom and seemed to start in the deepest part of the bayou beyond the Sixty-third Street wharf, which was artificially dug out. My findings agree with those of Connell and Cross that mortality began after the boils took place and the "milky" (turbid) water was visible. Our conclusions are similar as to the cause of the trouble, with the exception that Connell and Cross have noted the presence of numbers of *Gonyaulax* in the first stages. In fact, the findings diverge only in different suggestions as to the cause of low oxygen and putrefaction.

The fact that *Gonyaulax* caused the mortality or is any more than "associated" with it remains to be shown. In fact, if the *Gonyaulax* of Offatts Bayou is not poisonous, then the same result and mortality could be produced in this blind lagoon of relatively stagnant water by a bloom of diatoms, ciliates, bacteria, or any other microplankton.

Many intensely interesting questions concerning dinoflagellate blooms and mass mortality of marine organisms go unanswered. Following the recent vast outbreak, Federal, state, and private agencies spent some $50,000 or more primarily for a study along the west Florida coast, where mortalities are known to occur on an average of once every 10 years, with skips of 30 years. If the recurring Offatts Bayou mortality is caused by, or is associated with, dinoflagellate blooms, it presents a unique opportunity in the Western Hemisphere, not only because of dependable recurrence but also because of the relatively small scale of the phenomenon, which makes it more amenable to analysis than the vaster phenomena of the open sea.

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References

1. LUND, E. J. *Ann. Rept. Texas Game, Fish and Oyster Comm. (1934–35)* **47** (1936).
2. GUNTER, G., *et al. Ecol. Monographs,* **18,** 309 (1948).
3. CONNELL, C. H., and CROSS, J. B. *Science,* **111,** 359 (1950).
4. GUNTER, G. *Am. Midland Naturalist,* **28,** 631 (1942).

A RECENT report on mass mortality of fish associated with *Gonyaulax* at Galveston raises a number of queries, most of them concerning the nature of the data presented. The authors emphasize the differences in percentage of oxygen saturation as being significant, but at no time state the temperatures of the water. Without this important variable, these figures are as meaningless as their statement: "The concentration of *Gonyaulax* as indicated by the color of the water was the same. . . ." Was this a colorimetric determination or a subjective impression? The salt content of Offatts Bayou is given as "2.3% NaCl," and this is stated to be "normal." On what grounds? What are the precise depths to which the *Gonyaulax* "submerged deeply" in a body of water about 30 ft deep? Experiments with shrimp are mentioned, but not the species used or numbers of individuals, sizes, etc. Last, to one admittedly not a protozoologist, the illustrations of the organism do not appear clear enough to be diagnostic, and the authors admit that they preserved "an insufficient number of specimens."

This is not to question the basic assumption that *Gonyaulax* may be associated with conditions of mass mortality, but to point out that this incident was investigated and reported upon in such a way that it will be impossible to compare it in any adequate manner with subsequent occurrences.

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WITH great surprise I found in SCIENCE, September 29, 1950, the article by Connell and Cross, entitled "Mass Mortality of Fish Associated with the Protozoan *Gonyaulax* in the Gulf of Mexico."

May I draw your attention to the fact that the concurrent appearance of red water or water bloom (caused periodically by immense numbers of dinoflagellates, as well as other organisms) and mass mortality of fish was made known long ago by Margaretha Brongersma-Sanders, of the Rijksmuseum van Natuurlijke Historie, Leiden? Dr. Brongersma-Sanders' observations cover many places all over the world (including the east coast of North America), and your new article is indeed a useful addition to her work, since she recorded two occurrences of red water and mass mortality in the Gulf of Mexico but *not* along Galveston Island. This episode, however, occurred in the summer of 1949, whereas Dr. Brongersma-Sand-

ers' latest paper on this subject was published in 1948. For your convenience I give you the titles of the papers involved:

BRONGERSMA-SANDERS, M. De jaarlijksche visschensterfte bij Walvisbaai (Zuidwest Afrika) en haar beteekenis voor de palaeontologie. *Vakblad Biol.*, **24**, 13 (1943).
———. Een H_2S bevattend sediment met een hoog organisch gehalte uit open zee. *Geol. Mijnbouw*, new ser., **6**, 57 (1944).
———. The Annual Fish Mortality near Walvis Bay (Southwest Africa) and its Significance for Paleontology. Summary of lecture delivered to the Netherlands Zoological Society, Jan. 23, 1943. *Arch. néerland. zool.*, **7**, 291 (1945).
———. On the Desirability of a Research into Certain Phenomena in the Region of Upwelling Water along the Coast of Southwest Africa. *Proc. Koninkl. Nederland. Akad. Wetenschap.*, **50**, 659 (1947).
———. The Importance of Upwelling Water to Vertebrate Paleontology and Oil Geology. *Verhandel. Koninkl. Nederland. Akad. Wetenschap.*, Afdeel. Natuurk., Sec. II, **45**, (4) 112 pp., 7 figs.

J. C. Armstrong, of this museum, very briefly reviewed Dr. Brongersma-Sanders' 1948 paper in the *Geographical Review* (39, 673 [1949]). I know that another review of Dr. Brongersma-Sanders' work will be published very soon in the *American Journal of Science.*

Wouldn't it be advisable to insert an explanatory note in the next issue of SCIENCE giving due credit to Dr. Brongersma-Sanders' work, because it is really the first to have dealt with the association of red water and mass mortality, and also the bearing of all this on oil geology and vertebrate paleontology?

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MAY we first thank Dr. Hooijer for calling our attention to the valuable work of Margaretha Brongersma-Sanders. Briefly, his objections to our report seem to be:

(1) Dr. Brongersma-Sanders reported the concurrence of mass mortality of fish and the presence of plankton "long ago."

Explanation: If Dr. Hooijer's "long ago" is to be judged by the publication dates of his references (1943–48), the time is very recent in comparison with those listed in Kofoid's celebrated and voluminous monograph on the Unarmored Dinoflagellates (our ref. 7, 1921). In it Kofoid lists various authors and a number of such episodes (1910, 1911, 1914, etc.).

(2) Dr. Brongersma-Sanders first reported mass mortality of fish with dinoflagellates, "as well as other organisms," in the Gulf of Mexico.

Explanation: Dr. Hooijer lists 1948 as the date on which he rests this claim. If our reference 4 is investigated, it will be seen that since the west coast of Florida may also be described as in the Gulf of Mexico we have indirectly credited Gunter, Williams, Davis, and Smith for the first report of plankton associated with mass mortality of fish in the Gulf. This article was published in 1948, the same year as Dr. Brongersma-Sanders' article, but it contains a reference to a publication in 1947 by Dr. Davis.

(3) Dr. Brongersma-Sanders is "really the first" to have dealt with the association of red water and mass mortality of fish.

Explanation: The same as for Item 1.

If Dr. Hooijer will reread our first sentence, he must surely see that we made no one of the claims for a "first" with which he has charged us—that actually we had very carefully credited others whose ratings still seem to us to be valid. It also appears to us that our omission of Dr. Brongersma-Sanders' name from our references is not too heinous when it is recalled (1) that our discussion was limited to a comparison of the conditions along the east and west coasts of the North American continent and did not pretend to include South Africa or other parts of the world, and (2) that for the sake of brevity the names of a number of other authors were also omitted from our references, although their reports fell well within the limitations of the subject matter. That limitation was a matter of convenience solely and not because we were ignorant of the wide range in time, geography, and importance that the phenomena of "red water" have occupied. We attempted to imply that fact without excess verbiage by referring to the Old Testament story of the plagues of Egypt.

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Addendum

IN the report on the International Oxford Conference on Nuclear Physics (*Science*, **113**, 107 [1951]) the author did not receive proofs. He wishes to add that the experiments which led to the discovery and confirmation of the neutral meson are due to Björklund, Crandall, Moyer, York; Steinberger, Panofsky, and Steller; Steinberger and Bishop.

Erratum

IN making last-minute changes in the article by Piccioni, Rabbi, and Moruzzi (*Science*, **113**, 179 [1951]), the printer has inadvertently repeated two items in the table in column 2. This table should read as follows:

	Percentage
Ground cereals (wheat, maize, barley, oats, rye)	88
Wheat germ	5
Crude casein	5
Calcium lactate	1.5
Sodium chloride	0.5