oped fruits were found, some of which contained fully developed seeds (caryopses). Careful examination of this pistillate planting during the season did not disclose any staminate or perfect or hermaphrodite flowers. Hitchcock[3] reports that seedlings of *B. dactyloides* are monoecious, producing both staminate and pistillate branches which produce their own kind.

Experiments are now under way to make certain that no outside pollen will enter the place where we are attempting to produce a new crop of (unfertilized?) buffalo grass seed. If such caryopses materialize the first authentic instance of parthenogenesis in grass may become established, in so far as the writer is able to find in a search of the literature at hand.

The material providing this study came from 25 pistillate rooted branches set in a small plat of 50 square feet. From 865 spikelets 53 apparently clean and 341 diseased caryopses were obtained. The disease which resembles smut has been identified by Gertrude Tennyson as *Cercospora seminalis* Ell & Ev., an imperfect fungus. This and other fungi (*Helminthosporium*) are reputed to be the cause of considerable amount of the very low germination percentage of buffalo grass seed.

An attempt is being made to grow plants from some of the caryopses collected from this material. Recently, 30 caryopses from this plat were planted, 8 of which germinated. Of this number 6 plants survive at the time of writing, and this is admitted to be a very satisfactory percentage by local workers in this field of research. If the seeds from which these plants came were produced by fertilization with pollen it must have come from scattered staminate plants in the neighborhood or possibly from plants miles away and carried in by insects or on the balmy air of Oklahoma. Seeds of Dallis grass, *Paspalum dilitatum,* have been gathered in the air 5,000 feet above the city of New Orleans. Pollen grains of other plants have been gathered at a much greater height.

This report is being made at this time and place in the hope that it may come to the attention of others who may be interested and who will contribute additional information on the subject.

W. B. GERNERT

OKLAHOMA AGRICULTURAL AND MECHANICAL COLLEGE

PHOTOCHEMICAL OXIDATION OF AMMONIA IN SEA WATER[1]

PHOTOCHEMICAL transformations between ammonia, nitrite and nitrate have been frequently reported under a variety of conditions[2, 3, 4, 5]. Recently Drs. S. A. Waksman and C. L. Carey, of the Woods Hole Oceanographic Institution, and one of us (A.H.), carried out a number of qualitative tests for nitrite in sea water irradiated after the addition of nitrate and ammonia. These preliminary results, which will shortly be published, as well as the work of ZoBell[6] on the photochemical oxidation of ammonia, suggested a more quantitative study.

Accordingly, ammonium sulfate was added to sea water from various sources, and to distilled water, and determinations made for ammonia and nitrite before and after irradiation with ultra-violet light. Confirmation was so easily obtained of the change of nitrate to nitrite in sea water that further investigation of this was deemed superfluous for this preliminary investigation. Furthermore, the slow destruction of nitrite in sea water by ultra-violet light was conclusively shown, but the corresponding process in distilled water seemed much slower, even doubtful.

Finally, attention was entirely centered on the oxidation of ammonia to nitrite. Ammonia was determined by the method of Krogh,[7] which has been slightly modified to serve as a routine analytical method for sea water. Nitrite was determined colorimetrically by the well-known method of Griess.

The solution in each case was irradiated in a cell of 15 mm depth with crystalline quartz windows 70×16 mm, sealed on with picein. The light from a high pressure water-cooled quartz capillary mercury-vapor lamp,[8] operated at 150 v. and 3.5 amp., was concentrated on the exposure cell. The radiation from the lamp (1,950 to 9,000 Å) was of considerably higher intensity per unit of surface than that given by a commercial mercury-vapor lamp. Since the radiation passed through one cm of tap water, one fused quartz window and 25 cm of air, in addition to a crystalline quartz lens and window before entering the cell, it contained extremely little radiation below 2,200 Å.

The control cell was of construction identical to that of the exposure cell, but had glass windows and was painted black. The solutions in both cells were kept at 20° C. and stirred thoroughly.

Results showing the change of ammonia to nitrite are given in Table 1. All figures represent nitrogen in micrograms per liter.

In Sample 3 approximately one mg of ammonia-nitrogen was added per liter, but was not determined

[3] A. S. Hitchcock, Bul. 772, U. S. Department of Agriculture, 1920.

[1] Contribution No. 120 from the Woods Hole Oceanographic Institution.

[2] H. Thiele, *Ber. deutsch. chem. Ges.*, 40: 4914, 1907.
[3] B. Moore, *Proc. Roy. Soc.*, B., 90: 158, 1918.
[4] D. S. Villars, *Jour. Amer. Chem. Soc.*, 49: 326, 1927.
[5] N. W. Rakestraw, *Biol. Bull.*, 71: 133, 1936.
[6] C. E. ZoBell, SCIENCE, 77: 27, 1933.
[7] A. Krogh, *Biol. Bull.*, 67: 126, 1934.
[8] F. Daniels and L. J. Heidt, *Jour. Amer. Chem. Soc.*, 54: 2381, 1932.

TABLE 1

Sample No.	Description	Time of irradiation	Micrograms per liter: Ammonia-nitrogen	Nitrite-nitrogen	Ammonia loss
1.	Distilled water + NH_3	0	890	0	
		2 hr.	940	0	
2.	Distilled water + NH_3	0	980	0	
		2 hr.	940	0	
3.	Surface sea water + NH_3	0	1000 ±	0	
		1 hr.	....	112	
4.	Same	0	980	0	
		2 hr.	490	335	490
5.	Same	0	970	0	
		2 hr.	740	166	230
6.	Same	0	970	0	
		2 hr.	600	270	370
7.	Same, but radiated through Uviol filter	0	960	0	
		3¼ hr.	780	35	180
8.	Surface sea water, same as 3, 4, 5, 6, 7, but no added NH_3	0	68	0	
		1½ hr.	26	++	
9.	Sea water from wharf + NH_3	0	850	0	
		1 hr.	670	125	180
10.	Deep sea water + NH_3	0	940	0	
		1 hr.	740	270	200*

* Nitrate content of this water was 265. All other samples nearly nitrate-free (10–25).

quantitatively, either before or after radiation. In Sample 8 so much of the solution had to be used for the ammonia analysis that there was only enough remaining for a qualitative test for nitrite, which was very distinctly positive. No. 10 was from a mixed sample taken from a number of sources, all below 1,000 meters in depth, and consequently with a high nitrate content. The fact that the nitrite produced exceeded the ammonia lost in this sample is evidently due to simultaneous reduction of nitrate.

It is to be observed that the photochemical oxidation of ammonia takes place in sea water but not in distilled water, confirming in quantitative form ZoBell's earlier observations.

Passing the radiation through a Uviol filter in No. 7 reduced its efficiency considerably, and the questions arising from this fact will be the subject of further study.

With the exception of this sample and No. 10, already mentioned, a relatively constant proportion (68 to 73 per cent.) of the ammonia is transformed into nitrite.

This whole work must be considered preliminary to a more complete study of the extraordinary conditions surrounding photochemical actions in sea water.

NORRIS W. RAKESTRAW
ALEXANDER HOLLAENDER
WOODS HOLE OCEANOGRAPHIC INSTITUTION
AND UNIVERSITY OF WISCONSIN

SCIENTIFIC APPARATUS AND LABORATORY METHODS

STOP-COCKS FOR MECHANICAL OPERATION

GLASS stop-cocks have been incorporated in mechanical devices, but they are not well suited to this type of service because the amount of energy required to turn them is not constant but increases as the film of sealing compound wears thinner, which in turn may interfere with the operation of the device or may break the stop-cock. When a glass stop-cock is operated mechanically some provision must be made constantly to press the core inward as it is turned. Finally, the fact that glass stop-cocks are so subject to breakage when used as part of mechanical devices makes them unsuited to this kind of use.

A metal stop-cock,[1] used as part of a mechanical device, has been described. This stop-cock is used under conditions which are such that slight leaks are of no consequence.

The stop-cocks shown in Fig. 1 are of mild steel with the exception of the cores. Chrome steel is used in the cores to avoid the excessive friction which is produced when two surfaces of the same metal move against each other.

[1] C. F. Winchester, SCIENCE, 78: 2035, 607, December 29, 1933.

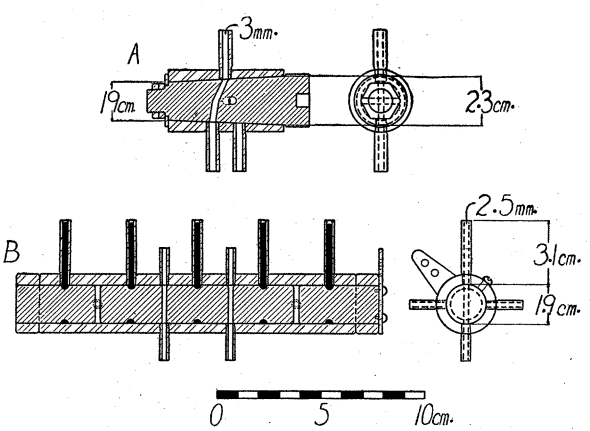

FIG. 1. A. Stop-cock of mild steel with chrome steel core held securely in place by nuts and a washer. B. Four mercury-sealed two-way stop-cocks in one unit. Core is of chrome steel, other parts are of mild steel.

The stop-cock shown at A in Fig. 1 differs in two respects from the conventional type, aside from the fact that it is of metal. The core is held in place by nuts and a washer just tightly enough to prevent leaks, but not tightly enough to cause undue friction. Holes in the core are not parallel, but as shown in the end view of the device are at right angles to each other.