potential lines and lines of flow of current; the earphones and the alternating electric current being, however, replaced by a galvanometer and by direct electric current.

The velocity-potential lines about the aerodynamic form were obtained by cutting out from the center of the conducting sheet the exact shape of the form the flow around which was to be studied and then mapping the electric equi-potential lines; the latter corresponding to the velocity-potential lines of a perfect fluid. Lines drawn perpendicularly to these velocity-potential lines gave the stream-line flow about the obstacle. Hence, a complete stream-line pattern about an obstacle was obtained without even making a model of the obstacle.

In mapping the stream-line flow about a form directly, an accurate model of the obstacle, cut from a sheet of highly conducting material, was placed at the center of the conducting paper. To insure that this model of the obstacle made good contact with the paper, small holes were drilled in the model whereby it was tacked to the table top.

Quantitative results were obtained from the patterns by securing an equal drop in electric potential between all lines; this corresponding to an equal drop in the value of the velocity-potential function or in the value of the stream function from line to line. By means of the well-known properties of these functions, the velocity at any point in the vicinity of the obstacle can be obtained in terms of the velocity at some point far removed from the obstacle. This equal drop in the value of the functions between the lines was secured by keeping the fixed electrode in its original position on the first line and displacing the exploring electrode any arbitrary distance toward the obstacle, noting the galvanometer deflection. The fixed electrode was then placed at the new position and the second line was plotted; the location of the fixed electrode for the plotting of the third line being obtained in the same manner as the corresponding point for the second line. The potential difference between the terminals was kept constant, so that the deflection of the galvanometer had the same significance throughout the entire mapping operation.

This method has the advantage that the pattern is obtained directly on the paper which serves as a record of the experiment. This is made possible by using as electrodes two lead pencils, sharpened at both ends, one end being inserted into a short glass tube, and sealed therein with Kotinsky cement. Mercury is poured into this glass tube and a wire is inserted from the top of the tube which is closed with a cork stopper, thus keeping the mercury from spilling and at the same time securely holding the wire in the mercury.

The writer has made numerous patterns on paper about various forms. Those forms for which the flow patterns are furnished by hydrodynamic theory yielded results in satisfactory agreement with the theoretical patterns and irregular forms yielded results which indicated the type of flow patterns which were later obtained in actual wind-tunnel experiments. The ground effect[6] has been obtained both by the reflection method and by the wind-tunnel method of securing the effect by the introduction of a flat plate of large extent beneath the airfoil section, the flat plate being in this case simply one of the straight copper terminals. Circulation effects can be obtained, as in Relf's method, by the application of an electric potential to the model of the obstacle.

Although the paper gives sufficiently accurate results for laboratory instruction purposes, its irregularity reduces the accuracy of any quantitative determinations quite considerably. If, instead of the paper, some thin, very homogeneous substance, such as stainless steel, is used, greater accuracy is possible.

The writer has used a 1/32 inch thick sheet of stainless steel and has secured very accurate results. With thinner sheets and a very sensitive galvanometer, exceedingly accurate mapping is possible.

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SPECIAL ARTICLES

DOES DILUTE HEAVY WATER INFLUENCE BIOLOGICAL PROCESSES?

IN view of the appearance of a number of articles which describe stimulating action of dilute "heavy" water on biological processes, we think that some results which we have obtained in this field may be of interest. A summary of the published work has been presented by Barnes and Jahn.[1]

The "heavy" water used in our experiments was obtained from the Ohio Chemical Company. The original water was slightly cloudy, but was clear after an ordinary filtration. The water was then distilled through two Pyrex glass systems fitted with efficient spray traps. In each distillation the middle three fifths of the distillate was collected. The second distillate, which was used for the experiments, was analyzed by means of an interferometer and was found to contain 0.46 per cent. D_2O. For the controls

[1] T. C. Barnes and T. L. Jahn, *Quart. Rev. Biol.*, 9: 292–341, 1934.

[6] E. P. Warner, "Aerodynamics," McGraw-Hill, 1927.

ordinary water, which contains 0.02 per cent. D_2O, was collected from a large laboratory still and was passed through the same stills that were used for the 0.46 per cent. D_2O. The 0.05 per cent. D_2O, used in several experiments, was prepared by diluting the 0.46 per cent. D_2O with the control water.

The growth of *Aspergillus niger* was studied by the method described by Mann.[2] Standard Pfeffer solutions, prepared with the 0.46 per cent. D_2O and the ordinary H_2O, were sterilized, inoculated and kept in an incubator at 34° C. for 5 days. At the end of this period all the mats were alike in appearance; they were slightly convoluted, and their fruiting was plentiful and uniform. The mats were washed, dried for 3 days at 65° C. and weighed. The dry weights are given in Table 1.

TABLE 1

GROWTH OF ASPERGILLUS NIGER[a]

Exp.	No. of flasks of each kind of water	Average weight of mats, grams	
		H_2O	D_2O
1	3	0.452 ± 0.027	0.435 ± 0.005
2	10	0.224 ± 0.029	0.229 ± 0.025
3	10	0.161 ± 0.023	0.181 ± 0.016

[a] In experiments 1 and 2, 0.46 per cent. D_2O was used; in experiment 3, 0.05 per cent. D_2O. In the first experiment 50 cc of solution were used in a 125 cc flask; in the others 15 cc in a 50 cc flask. Experiments 1 and 2 were performed by different workers. The precision given is average deviation.

It may be seen that we found no marked difference in the weights of the mats grown in the ordinary H_2O and in the 0.46 per cent. D_2O. The weights are of the same order of magnitude as those obtained by Mann[2] with ordinary water. Considering the percentage error in such work, the difference in the weights in experiment 3 is not to be regarded as significant. Thus, our results, in contrast to those of Meyer,[3] indicate no stimulating effect of dilute D_2O on the growth of *Aspergillus*. It should be pointed out that the D_2O content of the water in a Pfeffer solution is probably not the same as that of the original water, owing to the exchange of the D atoms with the hydrogen of the hydroxyl groups in the sucrose.

A study was made of the percentage germination of conidia of the powdery mildew of wheat, *Erysiphe graminis tritici*, incubated in hanging drops of ordinary distilled water and in two low concentrations of heavy water. The preparations were kept in darkness for 10 hours at 15° C. The results are shown in Table 2.

TABLE 2

GERMINATION OF CONIDIA OF ERYSIPHE GRAMINIS TRITICI AFTER 10 HOURS AT 15° C.

Culture medium	pH	Number of spores counted	Number of spores germinated	Percentage germination
0.05 per cent. D_2O	5.7	1127	616	54.7
0.46 per cent. D_2O	5.7	1078	591	54.8
Control (dist. H_2O)	5.7	1133	618	54.5
Control (nutrient soln.)	5.5	441	236	53.5
Control (tap water)	7.2	1145	851	74.3

In the tap water control at pH 7.2 about 99 per cent. of the viable spores (about 75 per cent. of the total number) had germinated after 10 hours at 15° C. The percentage of germination was considerably lower in the other preparations (at pH 5.5–5.7), but it was the same in the 0.05 per cent. and 0.46 per cent. D_2O as in the ordinary distilled water.

The growth of wheat roots in 0.46 per cent. D_2O and in ordinary distilled H_2O was also studied. The culture method was essentially the same as that described in a previous paper.[4] Seeds of Marquis wheat were soaked in the appropriate water for 3 hours and then germinated on moist filter paper at 28° C. until the primary roots were about 6 mm long (approximately 25 hours). Uniform seedlings were then placed on paraffined bobbinet so that their roots could grow downward into water contained in a beaker.

TABLE 3

ROOT GROWTH OF WHEAT SEEDLINGS IN 96 HOURS AT 19°–20° C. (EACH FIGURE REPRESENTING THE AVERAGE OF 25 ROOTS)

Exp.	Primary roots, mm		Lateral roots, mm	
	H_2O	D_2O	H_2O	D_2O
1	74.1	83.8	.....	.....
	72.7	72.9	.....	.....
2	90.0	87.6	82.9	79.6
			85.4	79.2
	85.8	86.4	80.9	77.6
			81.3	78.8

[2] M. L. Mann, *Bull. Torrey Bot. Club*, 59: 443–490, 1932.

[3] S. L. Meyer, SCIENCE, 79: 210–211, 1934.

[4] S. F. Trelease and H. M. Trelease, *Bull. Torrey Bot. Club*, 53: 137–156, 1926.

Twenty-five seedlings were used for each beaker, and in each experiment 50 seedlings were used for the 0.46 per cent. D_2O and the same number for the H_2O. The cultures were kept in darkness at 19°–20° C. for 96 hours, and at the end of this period the roots were measured. The results, shown in Table 3, indicate no significant difference in the effects of 0.46 per cent. D_2O and ordinary H_2O on the root elongation of the wheat seedlings.

The rate of the respiration of wheat seedlings at 28.5° C., as indicated by O_2 consumption, was measured by means of Warburg manometers. The seeds were soaked in the appropriate water for 3 hours and then allowed to germinate for about 24 hours on moist filter paper at 28° C. in a dark incubator. At the end of this period there was no difference in the appearance of the seedlings. Seedlings of the same root length were then placed on moist filter paper in the Warburg vessels. In each experiment three vessels, each containing 8 seedlings, were used for the dilute D_2O and three for the ordinary H_2O.

No difference was found in the rate of O_2 consumption by the seedlings in dilute D_2O and H_2O. The plot of O_2 consumption against time for the seedlings in each vessel gave practically a straight line over the period of an experiment (approximately ¾ hour). In each experiment the six lines (three for dilute D_2O and three for ordinary H_2O) lay close to one another, in a random order. The numerical data are given in Table 4.

TABLE 4

OXYGEN CONSUMPTION BY WHEAT SEEDLINGS[a]

Exp.	Root length of seedlings used, mm	O_2 consumption by 8 seedlings, cmm/min.	
		H_2O	D_2O
1	1–3	2.92	2.93
2	3–5	3.04	3.02
3	1–3	2.84	2.96
4	1.5–3.5	3.03	3.05
5	3.5–6	3.28	3.26
6	1–3	2.87	2.82

[a] The rate given is the average from 3 vessels, the average deviation being less than ± 4 per cent. In experiments 1 to 4, 0.46 per cent. D_2O was used; in 5 and 6, 0.05 D_2O. In experiment 6 quartz sand was used instead of filter paper.

These results may be summarized by saying that in the investigation of four biological processes—namely, growth of *Aspergillus*, germination of conidia of *Erysiphe graminis tritici*, root growth of wheat and O_2 consumption by wheat seedlings—no significant difference was observed between the influence of dilute heavy water and that of ordinary water.

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PITYROSPORUM OVALIS AS A CAUSATIVE AGENT OF SEBORRHEIC DERMATITIS

IT has been popularly considered by many dermatologists that *Pityrosporum ovalis*, the so-called "bottle bacillus" of Unna, is the etiological agent of seborrhea capitis simplex (dandruff) and seborrhea corporis (scaling of the body). Unfortunately, the inability to grow the organism for any length of time kept the clinicians from proving this belief in compliance with Koch's postulates. The organism is a yeast-like, budding, non-filamentous fungus, ovoid to spherical in form. When seen in scales, the cells are usually bottle- or gourd-shaped, ovoid and thin-walled, 2–4 × 2–3 μ in size, or spherical and thick-walled, 3–9 μ in diameter.

Because of its supposed relationship to bacteria, early investigators used bacteriological media for cultivating the microbe, with no success. Later workers, finding it to be a fungus, had somewhat better results using mycological substrates. No one had been able to cultivate *Pityrosporum ovalis* beyond one or two subcultures. One of the writers (Moore) inoculated fresh slants of wort agar (product of the Digestive Ferments Company), pH 4.8, with scales from scalps having seborrhea and was able to grow the fungus in approximately 12 per cent. of the attempts (8 out of 90). The microbe was successfully subcultured and used in experiments to test its pathogenicity, or at least its rôle in seborrhea.

Laboratory animals, including rabbits, guinea pigs, rats, white mice and hairless mice, were inoculated as follows: Intradermally with a saline suspension; percutaneously (scratching the skin) with and without a lipid salve; cutaneously; and controls. Rabbits and guinea pigs gave favorable reactions with percutaneous inoculations. Mice, rats and hairless mice were negative.

A number of humans were inoculated as were the animals and, in addition, auto-inoculations with scales from the patient's scalp were made on the chest and in the axillae. The percutaneous inoculation with the application of whole culture of *Pityrosporum ovalis* produced seborrheic dermatitis in 50 per cent. of the patients, while the same inoculation with the rubbing in of a lipid salve gave approximately 85 per cent. reactions. Intradermal injections produced a distinct erythema in approximately 75 per cent. of the cases. Cutaneous tests were not very convincing, while auto-