show antagonistic action as demonstrated by Loeb[1] but with many exceptions and corrections. A point of considerable interest is that Na + Ca mixtures are not toxic for eggs but are markedly so for the embryo freed from the egg membrane.

To the writer it seems that by the methods outlined above definite quantitative information can be gained as to the fundamental site of action of various chemicals on the egg of *Fundulus*.

[1] Loeb, J., *Archiv ges. Physiol.*, 1894, **4**, 530; 1901–02, **38**, 68; 1905, **107**, 252.
Loeb, J., *Amer. J. Physiol.*, 1899–1900, **3**, 327; 1901–02, **6**, 411.
Loeb, J., *Science*, 1911, **34**, 653; 1912, **36**, 637; 1916, **44**, 574.
Loeb, J., and Wasteneys, H., *Biochem. Zeit.*, 1911, **31**, 450; **32**, 155; **33**, 489; 1912, **39**, 167.
Loeb, J., *J. Biol. Chem.*, 1915, **23**, 139; 1916, **27**, 339, 353, 363; 1917, **32**, 147.
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Loeb, J., *J. Gen. Physiol.*, 1922–23, **5**, 255.

ABSORPTION OF ULTRA-SONIC WAVES BY HYDROGEN AND CARBON DIOXIDE

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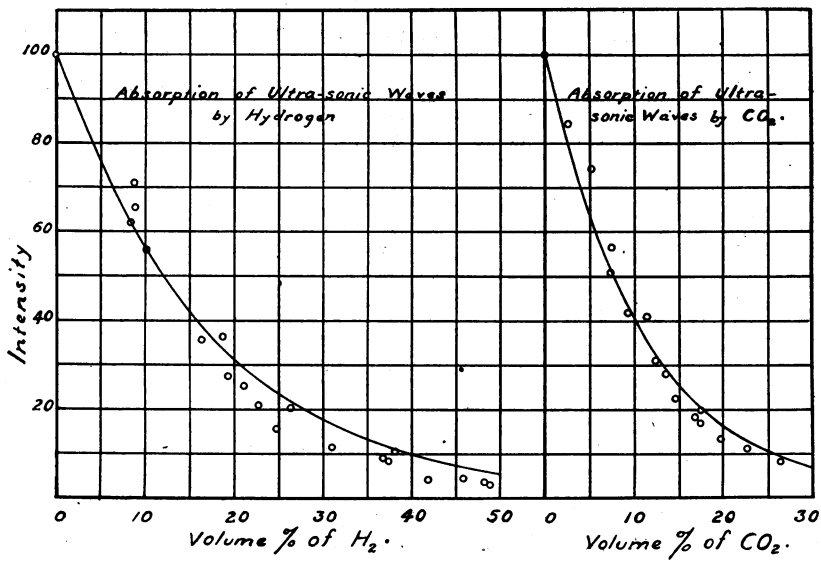
While measuring the velocity of very high frequency waves in CO_2, Pierce[1] noticed that the gas highly absorbs the waves. The following experiment confirms his observation and furthermore shows the somewhat astonishing fact that the lighter gas hydrogen also absorbs the waves more than air.

The experiment consists in passing an ultra-sonic beam through a mixture of air and CO_2 (or H_2) and measuring the intensity of the emergent beam by the pressure it exerts on a torsion vane. The source of the ultra-sonic beam is a piezo-electric crystal about $5.0 \times 4.5 \times 0.46$ cm. connected to an oscillating circuit. It radiates waves with a frequency of 612,000 per second in the direction of the shortest dimension through a circular hole in the electrode. The beam, after passing through a brass tube of about 1.25 cm. inside diameter and 5 cm. long which is closed on both ends by very thin celluloid films,[2] strikes a mica vane 1.5 cm. square. The crystal, tube and vane are all enclosed in a brass box, the inside of which is lined with wool. A dry mixture of air and CO_2 flows continuously through the tube. By means of a glass bulb of volume about 250 cc., through which the mixture passes before entering the tube, a sample of it can be taken.

The vane is suspended from a graduated torsion head by a quartz fiber 15 cm. long and 0.002 cm. in diameter. The pressure of the waves rotates the vane. In the experiment the rotation is more than 50 degrees when dry air is flowing through the tube. With the aid of a mirror attached to the vane and a lamp and scale about 60 cm. away the vane can be turned back to the original position. The amount of rotation of the torsion head which is required to accomplish this is taken as a measure of the intensity of the emergent beam.



The observation is made as follows: With the crystal oscillating and pure air flowing through the brass tube the reading of the torsion head is recorded. Then a little CO_2 is allowed to mix with the air. The flow of the gas is regulated by the pressure in the reduction valve placed before a capillary. The pressure on the vane decreases. A few minutes later when a constant mixture is flowing through the tube the vane is returned to the zero position and while at the zero a sample of the mixture is taken. Then the flow of CO_2 is increased and the above procedure repeated. Five samples of the mixture, each one corresponding to a definite intensity, are taken during each run. Finally the oscillator is stopped and the zero reading of the torsion head is taken.

The bulbs containing the samples of the mixtures are then weighed on an analytical balance with a sensitiveness of about 1.4 scale divisions per milligram, first when they contain the mixtures and then when they contain pure dry air. The percentage of the gas by volume in the mixture is

then equal to $\frac{1}{V} \cdot \frac{W}{(D_g - D_a)}$, where W is the difference in weight, V, the volume of the bulb, D_g, the density of the gas and D_a, the density of air. In this way the experimental points shown in the figure for both carbon dioxide and hydrogen were determined. The solid lines are true logarithmic curves. This phenomenon is being investigated further so it is not thought advisable to discuss the result at present.

In conclusion the writer is expressing his gratitude to Prof. A. J. Dempster, who has suggested this problem and is directing the work, for his valuable advice.

[1] G. W. Pierce, *Proc. Amer. Acad. Arts Sci.*, **60**, No. 5, 1925.

[2] For the method of making these films see J. Taylor, "On the Technique of Making Thin Celluloid Films," *J. Sci. Instr.*, **3**, 400, 1926.

ON THE FINE STRUCTURE OF SOME MERCURY LINES

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In his recent work on the fine structure of the mercury spectrum, Ruarke[1] has met with only limited success in his attempt to construct a fine structure energy level diagram. The most extensive work on fine structure in mercury has been by Nagaoka, Sugiura and Mishima.[2] Of their results Wood[3] has found the structure assigned to the line 2537 Å incorrect and the author has found that there appears to be some discrepancies in the structure reported for the lines 3650 and 2967 Å. The full report is being sent the *Phil. Mag.* for publication. The structures found for these lines are as follows:

3650 Å; +102, 0, −20, −32, −45 m. Å.

2967 Å; +22.5, +5.3, 0, −23, −29 m. Å. The component reported by Nagaoka, *et al.*, at −185 m. Å is probably correct, though it has not been observed in the present work.

In addition to these lines is one measured by Wendt[4] at 3983 Å. The structure of this line has been measured by no other observers and as Ruarke points out, his description of source used is rather meager. It was found that this line appeared very faintly in the ordinary Cooper-Hewit arc. In an arc of the type shown in the figure with a quartz window, Q, through which the arc was observed, it was found that the line 3983 Å appeared strongly at higher pressures of mercury vapor and at voltages above 25 volts. Since this line has been classified as due to a $P - F$