latter subjected to a Reformatsky reaction with zinc and ethyl bromo-acetate, thus effecting condensation, partial dehydration and lactonization simultaneously. The lactone[1] melts at 167–168° (corr.) and reacts positively towards Legal's and Tollens' reagents. It shows the following analytical figures: Calculated for $C_{23}H_{34}O_2$: C, 80.6; H, 10.0. Found: C, 80.4; H, 10.1.

A detailed description of this and other lactones will appear in *The Journal of Organic Chemistry.*

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SCIENTIFIC APPARATUS AND LABORATORY METHODS

THE MAGNETIC PROPERTIES OF CATALASE

RECENTLY a modification of Gouy's method of measuring magnetic susceptibilities has been elaborated in this laboratory primarily for the quantitative determination of free radicals of organic dyestuffs during the process of reduction. The result is an increased sensitivity over existing methods. The method will be described in a paper now in press and may be outlined very briefly as follows.

A long cylindrical vessel with a septum in the middle, dividing it into an upper and a lower compartment, quite similar to one first used by Freed and Casper,[1] and later especially by Pauling and Coryell,[2] is suspended between the pole pieces of an electromagnet. The upper end of the suspending wire is attached to the one pan of a semi-micro balance, which is magnetically damped, very nearly critically. The pointer of the balance is equipped with a scale of 200 divisions readable through a microscope, each line corresponding to about one hundredth of a milligram. The upper compartment of the vessel is filled with a solution, or suspension, of the substance to be measured. The lower compartment is filled with the pure solvent. After switching on the magnetizing current only the maximum deflection on the microscope scale is observed, which is reached in 15 seconds. The significance of each line of deflection is previously calibrated in terms of change in magnetic susceptibility. Repeated readings allow an accuracy, according to conditions, within one or a few per cent., even when the experiment is based on a magnetic pull of, say, one fifth of a milligram. This method has been used for the measurement of the susceptibility of crystallized catalase,[3] suspended in a dilute phosphate buffer. Thus far the measurements have been made under conditions not especially favorable for weighing, *i.e.*, warm and humid summer weather, and they may be worth repeating later on under better conditions. Even so, results could be obtained which were scarcely accessible to the method of direct weighing as used by Pauling and Coryell. Since catalase has four times the molecular weight of hemoglobin, yet not more iron in one molecule than the latter, and the concentration at which a suspension—not to speak of a solution—can be obtained, is limited, the increase in sensitivity over previous methods was essential for these experiments. The result obtained so far is that the magnetic moment of catalase, per gram-atom iron, is 4.64 Bohr magnetons. The probable error, under the unfavorable conditions mentioned, is estimated to be ± 0.3. This value would be close to 4.47 as obtained by Coryell and Pauling for ferri-hemoglobin hydroxide (alkaline methemoglobin), and smaller than for ferrohemoglobin (5.46) or ferri-hemoglobin (5.8). The magnetic experiments on catalase are being continued.

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[1] S. Freed and C. Casper. *Physical Rev.*, 36: 1002, 1930.

[2] L. Pauling and C. Coryell, *Proc. Nat. Acad. Sci.*, 22: 159 and 210, 1936.

[3] J. B. Sumner and A. L. Dounce, *Jour. Biol. Chem.*, 125: 33, 1938; 127: 439, 1939.

GLASS ELECTRODE FOR DETERMINATION OF HYDROGEN ION ACTIVITY OF SMALL QUANTITIES OF CULTURE MEDIA

INVESTIGATIONS of changes in pH in controlled cultures necessitate means of determining the pH of relatively small quantities of fluid. It was felt that a system whereby three determinations of pH could be made from as little as 1 ml of fluid would be very advantageous. After reviewing the possibilities of several micro vessels for this work, it was decided that a relatively large durable or condenser type of glass electrode, as described by MacInnes and Belcher,[1, 2] could be used, provided it was modified in some respects and a method developed for using the modified instrument. The results have been extremely satisfactory. The instrument is very stable and rugged. It is easily cleaned without being dismantled. Furthermore, the method of sampling and determination of pH precludes errors which might arise from addition or loss of gases such as CO_2.

A glass electrode is made (Fig. 1) with the following limitations and modifications:—The Corning No.

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[1] D. A. MacInnes and D. Belcher, *Industrial and Engineering Chemistry*, Analytical Edition, 5: 199, 1933.

[2] D. A. MacInnes and L. G. Longworth, *Transactions of the Electrochemical Society*, 71: 73, 1937.