mined by difference. Simultaneously, falling drop measurements were made to determine the densities of the supernatant fluids. The results of a typical experiment are given in Table I. The last column of this table shows the ratio of falling drop time to precipitable nitrogen. The constancy of this value indicates a close parallel between the data obtained by the two methods.

In the course of these studies, it was noted that the temperature at which the antigen-antibody system was incubated influenced the reaction as measured by the falling drop method. This is in accordance with Heidelberger's findings,[6] and the results are plotted in Chart 1.

Summary. The falling drop method devised by Barbour and Hamilton for the determination of the concentration of protein solutions has been found applicable to the estimation of the antibody content of antipneumococcus serum. After the precipitate has been separated from the reacting mixture by centrifugation, the density of the supernatant fluid can be determined in less than one minute by this method.

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A Silver-glass Micro-electrode for Use in a Micromanipulator.

GEORGE P. FULTON. (Introduced by F. H. Pratt.)

From the Department of Biology, Boston University, Boston, Mass.

In an investigation of the neuro-motor mechanism of small blood vessels,[1] the author needed to make micro-electrodes for the stimulation of small nerve fibers. The non-polarizable type (micro-salt-bridge), described by Ettisch and Péterfi,[2] Taylor,[3] Gelfan,[4] and Field,[5] was not necessary. Various polarizable types described in the literature were found to be inadequate. The platinum-quartz micro-electrode, devised by Taylor[3] and used by Pratt and Reid[6]

6 Heidelberger, *Bact. Rev.*, 1939, **3**, 41.

1 Fulton, G. P., and Lutz, B. R., *Science*, 1940, **92**, 223.

2 Ettisch, G., and Péterfi, T., *Pflüger's Archives*, 1925, **208**, 454.

3 Taylor, C. V., PROC. SOC. EXP. BIOL. AND MED., 1925, **23**, 147.

4 Gelfan, S., PROC. SOC. EXP. BIOL. AND MED., 1926, **23**, 308.

5 Field, M. E., *Skand. Arch. f. Physiol.*, 1935, **72**, 175.

6 Pratt, F. H., and Reid, M. A., *Science*, 1930, **72**, 431.

and by Steiman[7] for the study of single muscle fibers, proved to be expensive, required an oxygen flame to draw, and broke easily. The micro-electrode described by Sen[8] may be produced in quantity by the deposition of metallic platinum, gold, or silver on the surface of quartz or glass micro-needles, using Brashear's method for silvering glass or the method of sputtering with a high voltage discharge in a vacuum. Electrodes of this type had to be insulated individually by the application of shellac with a small brush. It was found that the insulation did not resist a strong faradic current.

A 3-inch length of silver suture wire (No. 28 or No. 30) was inserted in a closely-fitting, soft glass capillary and drawn in a minute gas flame to produce an insulated silver-glass micro-electrode. The type of micro-burner described by Chambers and Kopac[9] was used. When a satisfactory tip was obtained, the end of the silver wire was fused to a piece of copper wire. The copper wire and the initial portion of the shank of the electrode were then sealed in a 5-inch length of glass tubing (6 mm in diameter), by means of a beeswax-resin cement. This tube constituted the electrode holder and was inserted in an Emerson micromanipulator in place of the holder supplied with the instrument.

Micro-electrodes of one to 5 micra in diameter at the tip were obtained by this method. If the silver core was sealed by glass at the tip, the insulation could be removed from this point by passing a strong induced current through the electrode. The period of service was prolonged by cleaning the electrode with a small camel-hair brush beneath the surface of the electrolyte in which it had been used.

For use in stimulation the silver-glass micro-electrode was connected to an induction coil and made the active terminal for unipolar stimulation. It was polarizable, and the minute bubble of hydrogen gas, which appeared at the tip when the current was made and increased in magnitude during the time of stimulation, served to indicate the moment and duration of the stimulus. This property of the polarizable electrode has been of particular value in motion picture recording of the responses of small blood vessels to stimulation of minute nerves in the field under the microscope.

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[7] Steiman, S. E., *Am. J. Physiol.*, 1937, **118**, 492.

[8] Sen, B., PROC. SOC. EXP. BIOL. AND MED., 1930, **27**, 310.

[9] Chambers, R., and Kopac, M. J., *McClung's Handbook of Microscopical Technique*, New York, 2nd Edition, 1937.