which Asdell and Crowell present; but from their data we are unable to discover the basis for their statement that "age is a more important consideration than weight in determining the time at which vaginal opening occurs."

Summary. By varying the number of rats in a litter, animals of a slightly retarded growth rate were obtained. Rats raised to the time of vaginal opening, with 2 or 3, 4 or 5, and 10 or 11 in each litter showed vaginal opening at 46.5±5.6, 52.9±12.5 and 77.9±11.8 days, respectively.

While the range of ages at vaginal opening was considerable in the 3 groups, 33 to 105 days, the body lengths showed close agreement. The body lengths in the 3 groups at vaginal opening were 162.0±12.8 mm., 166.7±8.88 mm., and 168.8±9.27 mm., respectively. The body weights were similar in trend, but showed a greater variability than the body lengths.

A small group of 54 rats was maintained at an accelerated growth rate by administration of yeast. First estrus occurred at 41.1 days, but the average body length, like that of the other groups, was 166±7 mm.

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A Thermostromuhr with Direct Current Heater.*

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From an analysis of the method of measuring blood flow by the Rein[2, 3] thermostromuhr it became evident that the passage of the high frequency current through the intact blood vessel, on which a diathermy thermo-element is placed, results essentially in a localized heating of the wall of the blood vessel. Hence it was of interest to construct a thermostromuhr unit similar to the modified type introduced by Baldes, Herrick and Essex[1] in which a direct current

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1 Baldes, E. J., Herrick, J. F., and Essex, H. E., PROC. SOC. EXP. BIOL. AND MED., 1933, **30**, 1109.

2 Rein, Hermann, *Z. f. Biol.*, 1928, **87**, 394.

3 Rein, Hermann, in Abderhalden, Emil, *Handbuch der biologischen Arbeitsmethoden*, Berlin, Urban and Schwarzenberg, Abt. 5, Teil 8, 1928-1935, pp. 693-716.

heater replaced the platinum electrodes and likewise was spaced midway between the differential thermocouple. This arrangement of the Rein unit differs somewhat from the thermostromuhr described by Schmidt and Walker[4] in which the hot thermojunction is a silver trough interposed between a direct current heater and the blood vessel.

The arrangement of the direct current heater and the thermocouple in the bakelite block is shown in Fig. 1. The heating unit is made of No. 36 or 38 B. & S. gauge nichrome wire rolled to a ribbon 0.75 mm. to 0.5 mm. wide. This unit consists of a folded loop 'c' soldered to copper wires 'b' (2 strands number 38 B. & S. gauge), the resistance of the loop being at least one ohm. The unit

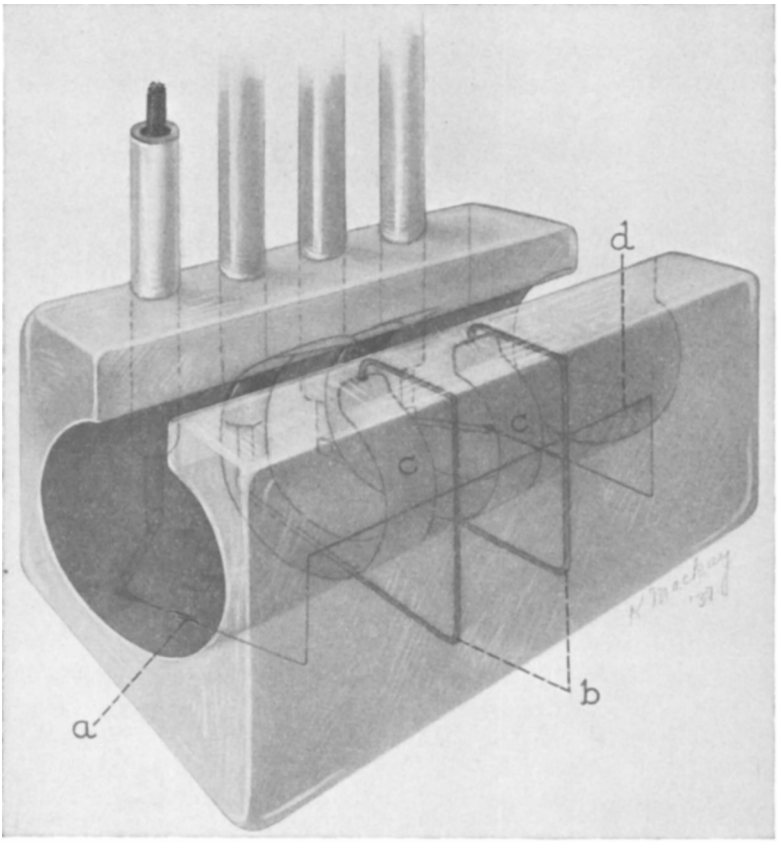

FIG. 1.
A thermostromuhr with direct current heater. The description is in the text.

[4] Schmidt, C. F., and Walker, A. M., PROC. SOC. EXP. BIOL. AND MED., 1935, **33**, 346.

is held in place by bakelite lacquer. The thermojunctions at 'a' are made by soldering copper wires (0.0016 in.) to a constantan wire (0.002 in.) which is embedded in the groove 'd'. The fine copper wires as well as the copper wires attached to the heater are then soldered to braided copper wires (17 strands 0.003 in. tinned copper). All grooves are filled by several applications of bakelite lacquer 3128 or Sterling varnish M-472, each application being followed by suitable air drying and baking. The final step is the insertion of the braided lead wires through rubber tubing 1/32 in. x 1/64 in. and the fixation of the rubber tube in the bakelite block with lacquer.

In using the above type of unit, the heater is connected to an electric circuit containing a 2-volt storage cell or 1.5-volt dry cell, a

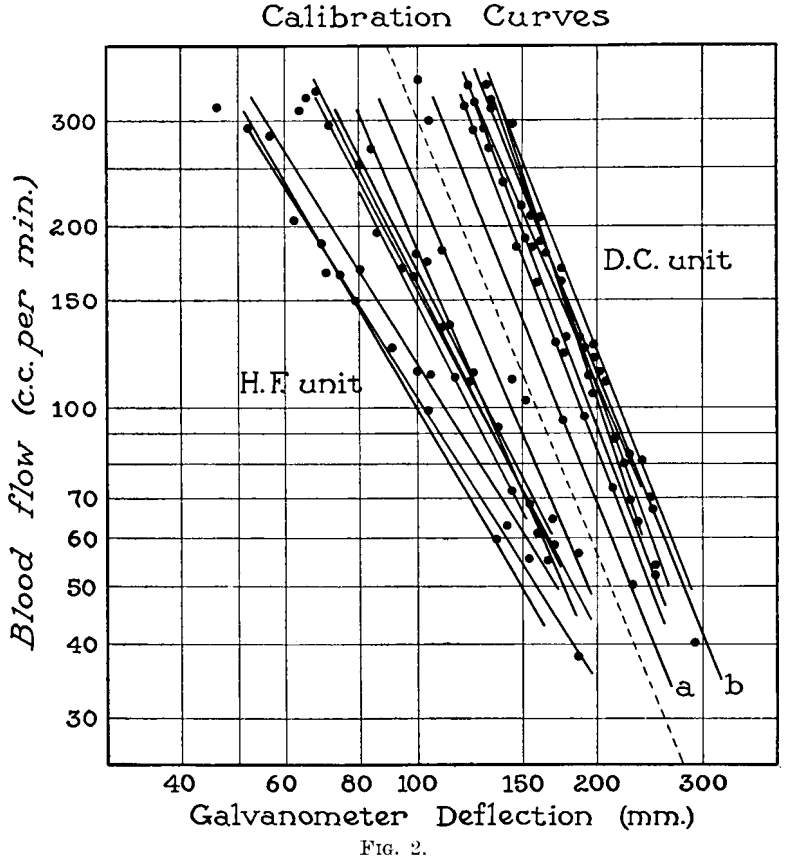

FIG. 2.

Relationship between blood flow and galvanometer deflection for 9 calibrations on a high frequency (H.F.) thermostromuhr and for 14 calibrations on a direct current (D.C.) thermostromuhr. All the curves for the D.C. unit represent "double values" except a and b.

variable resistance and a milliammeter capable of indicating currents up to 500 m.a. The thermocouple is connected directly to a galvanometer, suitable characteristics being one with a low coil resistance, 20 ohms for instance, and a sensitivity of 0.5×10^{-6} volt per mm. for a scale distance of one meter.

A comparison of a series of calibration curves for a high frequency thermostromuhr unit with a series of calibration curves for a similar unit with a direct current heater is shown in Fig. 2. The bore of both units is 2.5 mm. and the differential thermojunctions in each are spaced 1.2 times the diameter from the proximal edge of the heating electrodes or nichrome loop. The heating energy is calculated to be identical for each curve in both series, namely 0.060 calories per second. In the high frequency unit the current was approximately 23.5 m.a. and the high frequency resistance 450 ohms while a current of 475 m.a. was maintained in the direct current heater of 1.1 ohms resistance. In Fig. 2 is shown a series of 9 calibration curves giving the relation between blood flow and galvanometer deflection, with the same high frequency unit on different arteries or veins perfused with defibrinated blood. The other series of curves in Fig. 2 is obtained from 14 calibrations, using the same direct current thermostromuhr on different arteries and veins. A comparison of the 2 series indicates (1) that the direct current unit is as sensitive as the high frequency unit, and (2) that the calibrations check fully as well, if not better, with the direct current thermostromuhr.

Conclusions. A direct current thermostromuhr, similar in construction to the Rein high frequency unit, is described. It is believed that the direct current unit herein described offers all the physiologic advantages of the high frequency type of unit and at the same time introduces a simplified technic for measurement of blood flow.