

8367 P

A Thermostromuhr Operating on Storage-Battery Current.*

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This method is an attempt to secure the advantages of the thermostromuhr devised by Rein¹ without the complications attendant upon the quantitative application of high-frequency currents to living animals. The design and construction were arrived at by empirical trials on a schema. The actual testing and calibration were done entirely upon living animals.

The thermostromuhr element is incorporated in a bakelite block; it closely resembles that of Rein in external appearance and dimensions (Fig. 1). The upstream or cold junction (A) and the down-

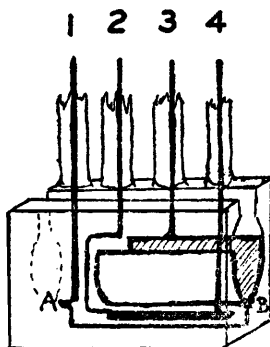


FIG. 1.

stream or hot junction (B) are silver-constantan and lie uncovered at the bottom of a trough 2-2.5 mm. in diameter. The hot junction (B) is at the downstream end of a semicylindrical plate of silver 5 mm. long and 0.04 mm. thick. Under this plate, insulated from it by a thin layer of mica, lies a strip of nichrome about 1 mm. wide, 0.04 mm. thick, and 5 mm. long; copper leads (2 and 4) carry to it, through a rheostat and ammeter, the current from a 6-volt storage battery. The thermocouple wires (1 and 3) are of silver; they are connected to a galvanometer along with a suitable dry-cell-potentiometer system to permit convenient setting of the galvanometer image

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¹ Rein, H., *Z. f. Biol.*, 1928, **87**, 394.

on the scale. When a blood-vessel is placed in the trough and the silver plate is heated by passing a suitable current (2 to 2.5 amperes) through the nichrome strip, the extent to which the silver plate is cooled by the blood stream varies directly with the volume of blood-flow. With our apparatus a change of 1°C. in the temperature difference between the two junctions causes a galvanometric deflection of approximately 10 cm.; this represents an E.M.F. change of approximately 0.045 millivolt.

Calibrations were made with the element installed on the renal veins of 17 rabbits and on the abdominal aortas of 5 rabbits, by comparing the galvanometric readings with the outflow from the renal vein as measured by the method of Barcroft and Brodie.² The animals were eviscerated and the abdominal circulation was confined to the left kidney. Renal blood-flow was altered by intravenous injections of hypertonic glucose, sulphate, and urea, and by bleeding and transfusion. If the blood-vessel completely covered

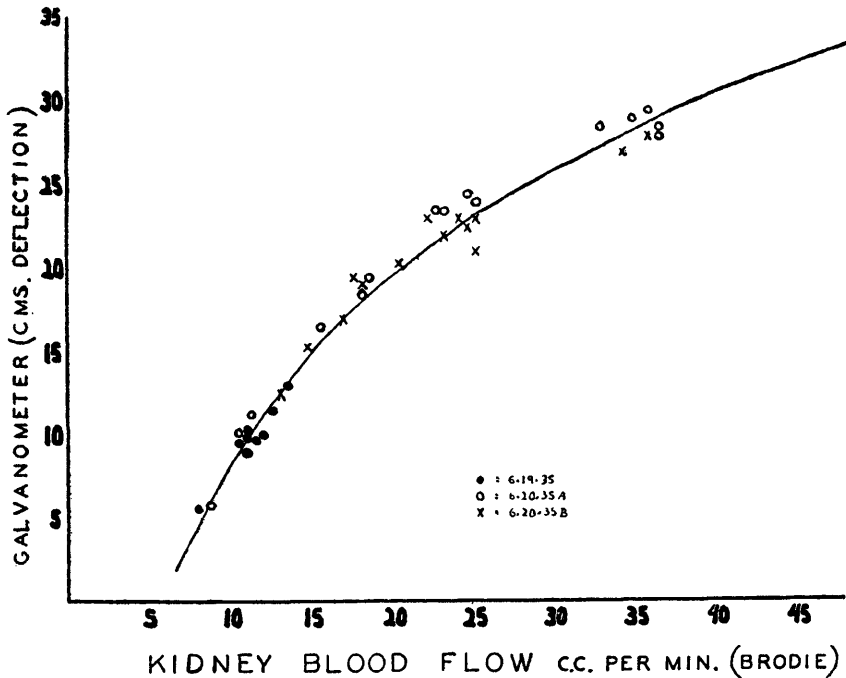


FIG. 2.

Acute calibration experiments. Unit 7-R-6 on renal veins of 3 rabbits. Form of curve: 1.0 cm. deflection of galvanometer equivalent to 7.72% change in blood flow. Heating current 2.0 amperes. Base line of galvanometer same in all experiments.

² Barcroft, J., Brodie, T. G., *J. Phys.*, 1905, **32**, 18.

the silver plate and the abdomen was closed, the base-line, (*i. e.*, the setting of the potentiometer, corresponding with the actual temperature difference between the two junctions) was constant for a given element and heating current applied to the same vessel of different animals of the same species; the position of the galvanometer image for a given renal blood-flow was also constant within approximately 10% except at flows lower than 10 cc. per min. Figs. 2 and 3 show representative groups of such experiments upon the renal veins and abdominal aortas, respectively, of rabbits. Similar results were obtained with the renal veins of 3 cats and the renal arteries of 5 dogs. Changes in abdominal temperature over the range 36-42°C. were without influence on the result. We have carried out corresponding calibrations upon the carotid, femoral, and iliac arteries of 3 dogs by perfusing the vessels with defibrinated blood by means of a pump; the curves were superimposable, but the base-lines varied considerably from animal to animal; we suspect that some of these discrepancies were due to adventitious circumstances, notably imperfections in the valves of the pump.

We have also performed calibration experiments upon animals in which an element had been installed upon the renal vein or aorta

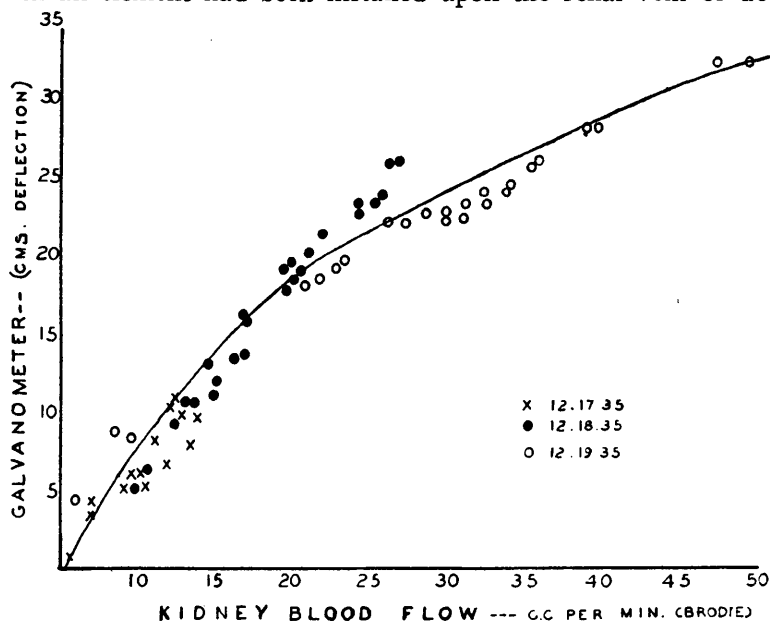


FIG. 3.

Acute calibration experiments. Unit 7-R-12 on abdominal aortas of 3 rabbits. Form of curve: 1.0 cm. deflection of galvanometer equivalent to an 8.33% change in blood flow. Heating current 2.0 amperes. Base line of galvanometer same in all experiments.

(rabbits) or renal artery (dogs) 24 hours previously. The aortic and renal arterial installations were successful: the base-line had not shifted appreciably and the calibration curves agreed with those obtained in acute experiments. The renal venous installations were unsuccessful because of shrinkage and distortion of the vein.

Summary. A thermostromuhr is described which differs principally from that of Rein in substituting storage battery for high frequency current. Its use is thereby vastly simplified. It has been calibrated on arteries and veins of living animals and gives promise of yielding quantitative information as to blood flow in unanesthetized animals.

We are anxious to express our gratitude to Dr. D. W. Bronk for his frequent helpful advice, and to Mr. A. J. Rawson of his department who has made for us the more perfect models of the instrument.

8368 C

Effect of Adrenalin on Blood Sugar and Lactic Acid in Addison's Disease and in Adrenalectomized Dogs.

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The hypothesis has recently been put forward that in adrenal insufficiency there is an inability of the muscles to produce lactic acid normally. Buell, Strauss and Andrus¹ found that in autolyzing pulverized skeletal muscle removed from cats suffering from experimental hyperthyroidism or adrenal insufficiency there was an inhibition of lactic acid formation, and suggested that the reason for the high blood lactate values found after exercise in patients suffering from hyperthyroidism or Addison's disease might be due to an impaired ability to metabolize the lactic acid formed rather than to an overproduction of lactic acid by the contracting muscles. Buell and Strauss² showed that in rats suffering from experimental hyperthyroidism the liver does not convert absorbed d-lactic acid into glycogen as readily as it does in normal animals, and the same

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¹ Buell, M. V., Strauss, M. B., and Andrus, E. C., *J. Biol. Chem.*, 1932, **98**, 645.

² Buell, M. V., and Strauss, M. B., *Bull. Johns Hopkins Hosp.*, 1934, **4**, 220.