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Lipids of the Tooth Pulp.*

HAROLD C. HODGE. (Introduced by W. R. Bloor.)

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Tooth pulps were collected by cracking teeth. Fibrous, calcified and putrescent pulps were discarded. For human teeth, the sample of pulps weighed 0.43 gm. Micro-lipid analyses were carried out using the Bloor oxidative procedures. The total lipids were 0.91% (moist weight), phospholipids 0.70%, and cholesterol 0.11%. For cow teeth, 214 incisor pulps weighing 33.72 gm. were collected. After lipid extraction, saponification of the residue gave 0.16% lipids unextracted. The total ether-soluble lipids (0.85% of moist weight) contained 50% unsaponifiable matter; of the saponifiable fraction, the fatty acids composed 76.6%, iodine number—72.3. Using the Twitchell procedure, 79.9% liquid fatty acids and 3.0% solid fatty acids were found.

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An Electromagnetic Flowmeter. Principle of the Method and its Application to Bloodflow Measurements.

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The Rein "Thermostromuhr",[1] the best method available for measuring flow in unopened vessels, is limited to mean flow measurements. In this laboratory a new method was developed which can follow rapid flow changes and which, besides, possesses the further advantage that the deflection bears a linear relation to the flow.

This flowmeter is based on the principle that an electromotive force is induced in a conductor moving so as to cut the lines of force in a magnetic field. If a wire is moving through the field in a direction perpendicular to its own axis and to the lines of force, then the

* This work was supported by a grant from the Rockefeller Foundation.

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

potential difference at the ends of the wire is given by the expression:

$$E = H \cdot l \cdot v \cdot 10^{-8} \text{ volts}$$

where E denotes the induced voltage, H is the strength of the magnetic field, 1, the length of the wire and v, its velocity.

A steady potential difference can be obtained by moving an endless metal belt, mercury or an electrolytic solution between the magnet poles. Here 1 would indicate the width of the conductor used. The induced electromotive force generated in the case of the solution can be tapped by introducing 2 non-polarizable electrodes through the wall of the tube through which the liquid is flowing. Since the induced voltage is proportional to the velocity of fluid flow, the current flowing through the galvanometer connected to these electrodes will be a linear function of the rate of flow. This was verified by actual trial with solutions of various concentrations of copper sulphate and sodium chloride using copper electrodes for the former and silver-silver chloride electrodes for the latter.

In the case of the blood vessels, their walls have a sufficient electrical conductivity to permit placing the electrodes outside in contact with their walls without opening them. This was demonstrated on

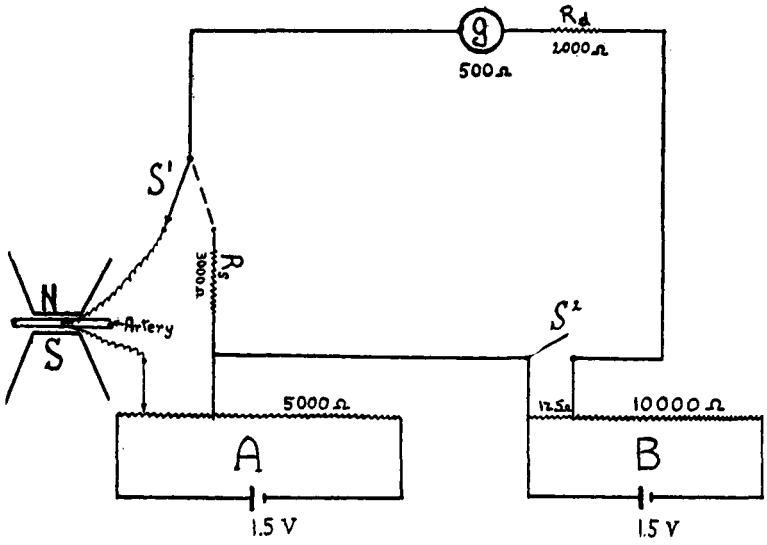

FIG. 1.

Scheme of the Flowmeter. N and S, magnet poles, one of the electrodes on the artery is seen between N and S, the other is hidden behind the artery; A, voltage source for compensating steady galvanic potentials; B voltage source for resistance measurements of artery with R_s, substitute resistance; S^1, double throw switch; S^2, shunt, G, galvanometer; R_d damping resistance.

arteries and veins, obtained postmortem, when perfusing them with saline.

The circuit used is shown diagrammatically in Fig. 1. The artery with the electrodes is shown between the two poles. The electrodes used consisted of zinc wrapped in cotton and dipped into a saturated solution of $ZnSO_4$. The electromagnet used had a magnetic field strength, when the poles were 4 mm. apart, of approximately 15,000 gauss, and the sensitivity of the D'arsonval galvanometer used was 1.3×10^{-8} Amp./cm.

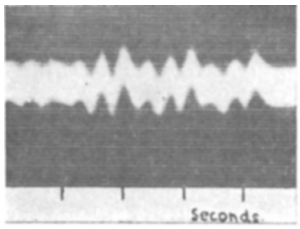

FIG. 2.

Fig. 2 shows the response of an Einthoven string galvanometer (sensitivity 0.1 millivolt = 1 cm.) to arbitrary pulsations of flow caused in the saline passing through an isolated carotid artery (reduced ½). The method employed is free of any inherent inertia

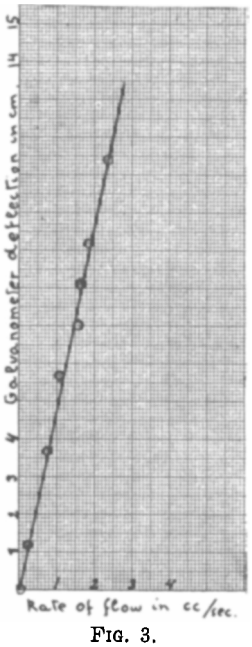

FIG. 3.

because it is based on a purely electro-magnetic effect. The limit of accuracy is determined by the characteristics of the galvanometer used.

Fig. 3 shows a typical calibration curve obtained with a carotid artery taken from a dog. The deflection difference observed on reversing the magnetic field was plotted against the rate of flow as measured with a graduate and stopwatch. It shows the linear relationship and gives an idea of the order of sensitivity of the particular arrangement.

The method was tried in living anesthetized dogs by placing the exposed but unopened carotid artery between the magnet poles. Deflections of as much as 14 cm. were obtained. The normal deflection was about 8 to 10 cm. With this sensitivity it is possible to determine changes in rate of flow of about 1% of the normal flow.*

I am indebted to K. Jochim for his valuable assistance and advice, to A. Meyer and S. Gaddas for technical assistance, and especially to Dr. L. N. Katz for his stimulating interest and guidance in developing the method.

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Effect of the Testis on the Mammary Gland.

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We reported[1] that treatment with testosterone benzoate stimulates the development and secretion of the mammary gland in normal and castrate male and female rats. While following up these experiments, it became obvious that a certain degree of mammary gland development is always present even in untreated male rats after they have passed puberty. It seemed of interest, therefore, to establish whether the male gonad would physiologically exert a specific stimulating effect on the mammary gland. The experiments which we wish to report on here prove this to be the case.

A group of 12 immature castrate males, 34 days old, and 12

* These results indicate that electrical currents are induced in the body by the earth's magnetic field. Calculations suggest that the order of magnitude of the voltage induced in an aorta is of the order of 10^{-7} volts.

[1] Selye, H., McEuen, C. S., and Collip, J. B., PROC. SOC. EXP. BIOL. AND MED., 1936, **34**, 201.