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A method of investigating eye movements. By H. HARTRIDGE and L. C. THOMSON. *Vision Research Unit, M.R.C.*

Hering (1899) thought that if a fixed pattern existed on the retina a straight line would be seen as broken and irregular, and that these defects are avoided by chance eye movements. Many other physiologists have held similar views (Anderson & Weymouth, 1923; Averill & Weymouth, 1925; Marshall & Talbot, 1942). Adler & Fliegelman (1934) thought that they had obtained experimental evidence in favour of these movements. Experiments by one of us supported the opposite view, namely, that the gaze may be held stationary with sufficient precision for the position at the fovea of the fixation points for rays of different colour to be determined.

The demonstration shows the apparatus which has been devised by us in order to investigate small rotations of the eye. The image of an ophthalmoscope filament lamp reflected in the cornea of the subject is projected by means of a lens system consisting of a low-power microscope objective and field lens. This lens system converges the image on to the focal point of a collimating lens, the rays from which are received either by a ciné camera or by the observer's eye via a prism monocular. In the former case the film is subsequently measured by means of a micrometer microscope.

The projection lens system is attached to a steel and plaster cap which accurately fits the head of the subject. Also attached to the plaster cap is a small reference lamp. An image of this lamp is arranged to lie at the focal point of the collimating lens, so that both it and the image reflected from the cornea are seen side by side. Thus rotations of the eye will cause relative movements between the reference and the corneal images. Movements of the head, on the other hand, will cause *both* images to move together on the ciné film. Consequently by the use of this method rotations of the eye may be measured in spite of the presence of head movements, which might otherwise disturb the observations. The camera is mounted on an optical bench, which is independent of the projection lens system in order to avoid the transmission of vibrations to it.

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Pipette-type Geiger counter for small quantities of biological fluids.
By D. M. MAURICE. *University College, London*

This counter was designed in connexion with investigations of the penetration of hard β-ray-emitting tracers into the intra-ocular fluids of the cat, and had to meet the following requirements: (1) use with small liquid samples of 0·5–1 ml.; (2) good reproducibility in the positioning of the sample with respect to the counter; (3) recovery of the sample unchanged, for further study.

It consists (Fig. 1) of a conventional cylindrical glass-walled counter, with a thin central window round which is sealed a glass cylinder, forming an annular space about 1 cm. wide and 0·5 mm. deep. Capillary tubes are fixed in the top and bottom so that the space may be filled with the sample by suction; just under 0·5 ml. is necessary.

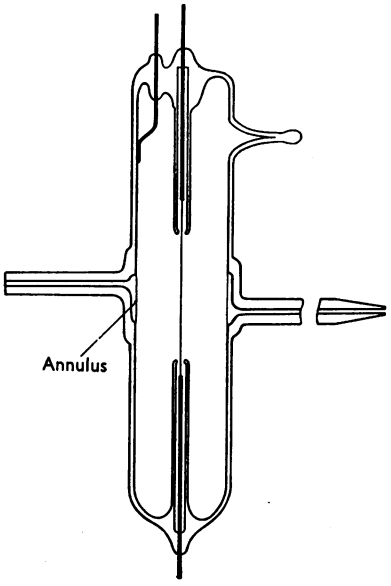

Fig. 1.

Requirement (2) is evidently satisfied; no trouble has been experienced with air locks or bubbles provided that ordinary care was taken in filling.

On blowing the sample out, just over three-quarters are recovered. A fairly constant fraction remains behind, and use may be made of this property in order to avoid cleaning and drying the counter between samples if only about 5% accuracy is aimed at. The residue of the old sample may be allowed to contaminate the new and an appropriate correction made, or, alternatively, the counter may be washed out with water, the diluent effect being equal on all samples.

If greater accuracy is required, or contamination of the sample is not permitted, the counter must be washed and dried. The procedure used has been successive rinsing with water, alcohol, ether and ether containing a trace of caprylic alcohol, followed by removal of the ether in a current of air. The counter can be emptied, cleaned and refilled within 3 min.

A d.c. amplifier with alternative a.c. coupling. By P. O. BISHOP and E. J. HARRIS. *Department of Anatomy and Biophysics Research Unit, University College, London*

An amplifier is used, with a gain of over 10^6, for studying resting potentials and 'slow' waves in brain cells.

An ergometer for myothermic experiments. By A. V. HILL. *Biophysics Research Unit, University College, London*

This ergometer was designed to avoid the dissipation of mechanical energy in the muscle when it relaxes, and—with the appropriate load—to obtain the greatest possible work. The force to be overcome diminishes as the muscle shortens, the weight finally tips over and the muscle is left unloaded. The load and the distance lifted are adjustable: the work done is their product.

An equipment for the display and recording of physical changes associated with physiological events. By V. H. ATTREE. *Biophysics Research Unit, University College, London*

The use of an appropriate 'pick-up' enables certain physical changes (e.g. mechanical, thermal, optical, etc.) to be transformed into voltage changes which may be displayed on a cathode-ray tube. The equipment amplifies the electrical signals from the 'pick-up' and provides a display which is normally recorded on a fixed plate camera. A double-beam cathode-ray tube is used enabling two signals to be recorded simultaneously. In the demonstration given the signal on one trace records the heat production in a muscle, and on the other trace the associated mechanical movement. 'Pick-up' units for changes of pressure, temperature, velocity, acceleration and force have been used in this laboratory, but it is possible to record changes in many other physical quantities.

The measurement of pressure by the change of temperature in the adiabatic compression of oil. By A. V. HILL. *Biophysics Research Unit, University College, London*

The temperature of any substance with a positive coefficient of thermal expansion rises reversibly during compression. Paraffin oil has a large coefficient and its temperature rises about 0·012° C./atm. The temperature change can be measured with a 'thermistor'. The instrument shown has been used to determine the pressure developed (100–300 mm. Hg) inside a frog's gastrocnemius when it contracts.

Counting and scaling apparatus. By E. J. HARRIS. *Biophysics Research Unit, University College, London*

This equipment, constructed in the laboratory apart from the scaler, is used for the measurement of radioactivity. Radioactive isotopes of potassium and sodium are being applied to a study of the kinetics of the penetration or adsorption of these ions in muscle.

A mass spectrometer (Nier type). By E. J. HARRIS. *Biophysics Research Unit, University College, London*

This equipment, constructed in the laboratory, is for using the stable heavy isotopes of carbon and nitrogen to study the metabolism of compounds of biological importance.

Response of the phrenic nerve of the rat to rectangular pulses of direct current. By G. A. MOGEY and J. W. TREVAN. *The Wellcome Physiological Research Laboratories*

Just supra-maximal stimulation (1–2 V.) of the isolated phrenic nerve in Ringer's solution (Bülbring, 1946) with rectangular pulses of d.c. shorter than about 1·26 msec. does not produce maximal contractions of the diaphragm. Increasing the duration of the stimulus above 1·26 msec. produces progressive increase in size of contractions of the diaphragm until the duration reaches about 50 msec. which gives a 'twitch' equal to that produced by a stimulus of 'infinite' duration. The increment in contraction takes place at first in steps. In one experiment sudden increments took place at 1·26, 1·40 and 1·58 msec., the height of contraction for durations of stimuli between the steps remaining constant. In some experiments no steps are apparent, the height of contraction increasing more or less smoothly, with smooth equal increments of duration of stimuli above about 1·26 msec. The phenomenon persists for many hours after setting up the preparation, although the height of the twitches produced by the longer stimuli may diminish.

It is unlikely that the effect is due to the existence of fibres of differing chronaxie, for the size of chronaxie required would exceed any that have been reported by an enormous margin. The most probable explanation is that the longer-duration stimuli produce a repetitive response in the nerve fibres, and the corresponding muscle 'twitches' are, in fact, short tetani. Where the increment in contraction is stepwise, the rate of repetitive response is synchronous in the majority of the fibres. Asynchronism leads to a gradual and not a stepwise increase in height of contraction. The maximum number of steps observed was four at durations lower than about 6 msec., so that asynchronism always sets in at about this duration. *d*-Tubocurarine abolishes the difference between the effects of long and short stimuli in concentrations too low (about 1×10^{-6}) to diminish the height of the response to short stimuli. This corresponds to the known fact that the tetanic response of a muscle to rapidly repeated nerve impulses is converted by *d*-tubocurarine into a single twitch. Eserine (1×10^{-8}) increases the response of the muscle to a stimulus of less than 1·26 msec., and the effect is abolished by minute doses of *d*-tubocurarine (2×10^{-8}). The eserine presumably produces a repetitive response of the nerve ending to a single impulse in the nerve fibre.

The occurrence of repetitive responses of nerve fibres has often been reported before, but usually as occurring under special conditions (e.g. Erlanger & Blair, 1936). It seems to be the normal response of the isolated rat and mouse phrenic nerves to stimuli of sufficient duration.

We are indebted to Dr G. L. Brown for much stimulating discussion of our results.

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Heat production in a muscle twitch. By A. V. Hill. *Biophysics Research Unit, University College, London*

The heat production in a muscle twitch begins at the same moment (within 1 or 2 msec. at 0° C.) as the mechanical response. It starts off at its maximum rate and finishes as contraction ends. In relaxation no heat appears unless mechanical work is dissipated in the muscle. There is no sign of heat absorption at any stage in contraction or relaxation. With varying load (from constant initial length) the work done may vary from 0 to 50 % of the heat, but the heat is constant and independent of the load and work. Clearly the stimulus does not fire a 'cartridge' containing constant energy. Can heat and work be derived from different sources?

When a muscle relaxes without load it remains shorter; this can scarcely be due to folding of the fibres because, stimulated in the shorter condition, it produces much less heat than if gently pulled out beforehand.

The maximum work in the single twitch of a frog's sartorius at 0° C. is sufficient to lift the muscle 60–70 cm. against gravity; this is at least as great as at a higher temperature. The mechanical efficiency of the initial process may be as high as 35 %. The recovery heat at 0° C. is about equal to the initial heat plus work, as at other temperatures.

If excitation be assumed to occur at the surface of a fibre, diffusion inwards is far too slow to account for the speed at which contraction can develop. Some physical change, not a chemical substance, must be propagated in.

These facts tend to be disregarded in current speculations about the chemistry of contraction.

Central summation in vasodilator and respiratory reflexes. By H. Rosenberg. *Department of Physiology, Royal Veterinary College, London*

In order to apply repeated stimulation of variable but identical rates, simultaneously to two nerves, at a reproducible strength predetermined independently for each nerve, the output of a square wave oscillator was fed, with a 2 μF. capacitor in series, into the primary of a stepdown transformer whose

secondary was connected with the primary coils of two matched inductoria in parallel.

The strength of the stimulation of either nerve was adjusted, while the secondary coil of the opposite inductorium was shunted by a non-reactive resistor, approximately equivalent with the nerve resistance to 0·1 msec. rectangular pulses. Under these conditions the shocks are non-oscillatory and reach the peak in 0·1 msec. on make and in 0·09 msec. on break (fall to 30% of maximum in 0·35 and 0·31 msec. respectively). The shock voltage on make is about 10% higher than on break. As the bilateral shocks are synchronous, a coincident arrival of the afferent impulses at the medullary half-centres may be presumed.

Unilateral stimulation of the aortic nerve (rabbit under urethane, both aortic nerves, sympathetics and vagi cut, both carotid sinuses excised) shows temporal summation of vasodilatation, e.g. no response at 4 and clear fall of arterial pressure at 30 double shocks per sec. (make-break interval 12 msec.). In the visceral effectors concerned, temporal summation in part probably is peripheral (Wright, 1928), while the increase in respiratory rate observed under these conditions cannot be assigned to the somatic effectors.

On bilateral subthreshold stimulation, a fall of arterial pressure, or an increased fall when the strength on one side only is subliminal, points to spatial summation in the, presumably linked, vasodilator half-centres (summation in afferents evidently ruled out). If stimulation of both nerves is supraliminal, a fall in excess of addition of the separate responses seems indicative of true spatial central summation, actually observed in the vasodilator reflex response. In the respiratory reflex response, increase in rate above addition was found while ventilation did not exceed partial addition (respiratory responses uncertain or absent in many animals). Gesell, Hansen & Siskel (1947) obtained similar results on stimulation of the carotid sinus nerves in dogs.

Spatial addition and temporal summation were also found in vagal respiratory inhibition (rabbit, same conditions). Rebound often was marked.

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A double histamine test for inhibitors of gastric secretion. By HENRY T. HOWAT and B. SCHOFIELD. *Department of Physiology, Manchester University*

In fasting chloralosed cats a tube is passed into the stomach from an opening in the oesophagus, the pylorus ligated, and the stomach washed out with warm water. Atropine sulphate (1 mg./kg.) is administered intravenously and the rectal temperature kept constant.

After approximately 1 hr., the stomach is washed with N/200-HCl, and 25 c.c. are left in. This is renewed every 15 min. and the free and total acid of the samples estimated by titration with N/20-NaOH. The results are plotted as output of N/10-HCl per 15 min. period. Histamine acid phosphate in 0·9% NaCl is administered intravenously at a constant rate of 0·0045 mg./kg./min. (0·00155 mg. histamine base) for 45 min. from a motor-driven syringe. The acid secreted constitutes the first response. After the acidity has returned to the basal level, the 45 min. histamine injection is repeated, producing the second response. The test substance is administered intravenously between the two injections.

A series of seventy-six experiments show a mean first response of 10·20 c.c. total acid (S.E. of mean ±0·44 c.c.). The difference between the first and second responses is expressed as a percentage of the first, and in a series of experiments the mean of these percentage differences is calculated, this being described as the *mean % diff.* A control series of twenty-five experiments with no intervening injection show a *mean % diff.* of $-10{\cdot}8 \pm 3{\cdot}57$.

Tests have been performed on the following substances:

(1) *Urogastrone* prepared by the method of Gray, Wieczorowski, Wells and Harris (1942), and tested in the crude and purified forms;

(2) *Enterogastrone concentrate* prepared as described by Greengard, Atkinson, Grossman and Ivy (1946);

(3) *Neo-antergan* (Anthisan M. & B.) as an example of the synthetic antihistamine drugs.

Significance was tested by Fisher's *t* test (Fisher, 1946).

Substance	Dose	No. of exps.	Mean % diff.	S.E. of mean	Significance of variation from mean % diff. of controls
Urogastrone, crude	10–25 mg.	11	−80·3	± 4·12	$t=11{\cdot}5$, $p<0{\cdot}01$ Highly significant
Urogastrone, purified	1–6 mg.	8	−49·1	± 9·68	$t=4{\cdot}6$, $p<0{\cdot}01$ Highly significant
Enterogastrone concentrate	1 dog unit	3	−69·7	±13·39	$t=5{\cdot}3$, $p<0{\cdot}01$ Highly significant
Enterogastrone concentrate	<1 dog unit	5	−17·0	± 9·65	$t=0{\cdot}69$, $p=0{\cdot}5$ Not significant
Neo-antergan	2–10 mg./kg.	6	+21·3	± 7·96	$t=3{\cdot}9$, $p<0{\cdot}01$ Highly significant increase
Controls		25	−10·8	± 3·57	

The method shows satisfactorily the inhibition of acid secretion in the stomach produced by recognized inhibitors at suitable dose levels. Neo-antergan shows no inhibition in small doses, and in larger doses the output of acid in the second response is increased.

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The role of calcium in contractures of the rectus abdominis of the frog. By E. J. DENTON. *Biophysics Research Unit, University College, London*

Recti abdominis of frog (*Rana temporaria*) were soaked in calcium-free solutions at room temperature for several hours. The long-continued contracture, rising slowly and lasting indefinitely, in response to acetylcholine (10^{-5}) or to potassium (4·5 g. KCl/l., i.e. 30 times that in Ringer), which is typical of the rectus muscle, no longer appeared. The response was now similar to that of the sartorius, rising quickly and lasting less than a minute. Calcium added to the soaking fluid restored the power of the muscle to give long-continued contractures.

The response to acetylcholine or potassium remaining after soaking in calcium-free solution could be abolished by raising the potassium concentration to that required to abolish response to electric shocks, i.e. about 6 times that of Ringer. Curarizing the muscle abolished the response to acetylcholine but not that to potassium.

The addition of calcium which restored the contracture response did not change the threshold or maximum response to alternating current (50 cyc./sec.).

The long-continued contracture to acetylcholine or to potassium increased in amplitude with the calcium concentration up to 0·05 g. $CaCl_2$/l., but was independent of it above this value.

Concerning an excess of sodium and chloride in the aqueous humour of the cat and dog. By H. DAVSON, W. S. DUKE-ELDER and D. M. MAURICE. *Department of Physiology, University College, London*

If the aqueous humour were a simple dialysate of plasma, sodium and chloride should be distributed between the two fluids in accordance with the Gibbs-Donnan equilibrium. Van Slyke calculated a figure of 1·04 for the ratio of the concentrations of sodium in plasma and its dialysate, and a figure of 0·96 for the corresponding chloride ratio. In the cat and dog the values for the sodium ratio (R_{Na}) have been found to be $1{\cdot}03 \pm 0{\cdot}004$ and $1{\cdot}04 \pm 0{\cdot}003$ respectively (Davson, 1939; Davson & Weld, 1941); these findings suggest that the sodium ion is distributed in accordance with simple electrolyte equilibria. The values of R_{Cl} have been found to be 0·945 and 0·90 for the cat and dog respectively; the ratio for the dog, in particular, is greatly different from Van Slyke's theoretical ratio of 0·96, and it has been suggested that chloride is secreted into the aqueous humour of this animal. Studies with collodion membranes (e.g. by Greene & Power, 1931) indicate that Van Slyke's theoretical ratios, R_{Na} and

R_{Cl}, should be in the region of 1·08 and 0·99 respectively, presumably because the activity coefficients of the ions are not the same in the two fluids. If this is true for aqueous humour and plasma, the two fluids are not in thermodynamic equilibrium with respect to the sodium and chloride ions, the observed ratios being the result of the presence of an excess of these ions in the aqueous humour. On dialysing aqueous humour against plasma, by means of a collodion sac, the excess salt should pass from the aqueous humour into the plasma; as a result, the values of R_{Na} and R_{Cl} should rise; moreover, the conductivity of the plasma should rise at the expense of that of the aqueous humour. Experiments on the aqueous humour of cats and dogs confirm this expectation; the mean value of R_{Cl} in the dog, for example, rises from 0·91 to 0·98 after dialysis, and the mean value of R_{Na} rises from 1·04 to 1·06. In the cat, R_{Na} rises from 1·04 to 1·07 and R_{Cl} from 0·95 to 0·965. With several cats it was observed that R_{Cl} was unchanged on dialysis. Changes in conductivity of aqueous humour and plasma were found, consistent with the migration of salt from the former fluid.

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Electric membrane properties of frog muscle. By BERNHARD KATZ.
Biophysics Research Unit, University College, London

Hodgkin & Rushton (1946) have recently described a method by which the electric constants of non-medullated nerve fibres could be measured. It consists essentially in the application of a rectangular current to the axon surface

TABLE 1. (Temperature range 18·5–28° C., mean 22° C.)

Preparation	Bundles of m. add. magnus (1–4 fibres)	M. ext. longus dig. IV
No. of experiments	9	14
Mean fibre diameter (μ.)	75	43
Characteristic length (mm.)	0·65 (0·47–1·15)	1·1 (0·75–1·5)
Membrane time constant (msec.)	9 (4·6–27)	18·5 (7·3–38)
Specific resistance of myoplasm (ohms cm.)	188 (131–280)	255 (206–355)
Transverse resistance of membrane (ohms cm.^{2})	1500 (650–4500)	4300 (1500–9500)
Membrane capacity (μF./cm.^{2})	6·1* (4·3–10)	4·4† (2·9–5·9)
Percentage external fluid space	17 (10·5–26·5)	27 (17–45)

* S.E. of mean 0·58 μF./cm.^{2} (9 experiments).
† S.E. 0·23 μF./cm.^{2} (14 experiments).

and in an analysis of wave form and attenuation of the potential changes in the extrapolar region. Similar experiments were made on frog muscle using isolated bundles (1–4 fibres) of the m. adductor magnus and the m. extensor longus dig. IV which consists of about fifty fibres. Mean results are shown in Table 1. The value of the membrane capacity is of particular interest, for it is about 5 times greater than the values obtained from various types of non-medullated nerve. The muscle fibre is known to be relatively slow in its electric reactions; the conduction velocity is lower and the time factor of excitation larger than in non-medullated nerve fibres of similar size. It appears that the high electric capacity of the muscle membrane is an important factor in determining these physiological differences.

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The regulation of the afferent discharge from a frog muscle. By B. KATZ and J. Z. YOUNG. *Biophysics Research Unit and Anatomy Department, University College, London*

In a recent paper Kuffler & Gerard (1947) have shown that frog muscle is supplied with small motor nerves which elicit slow contractions quite unlike the ordinary muscle twitch. Matthews's (1931) experiments indicate that the intrafusal muscle fibres are innervated by such small axons, and it seemed possible therefore that the contractions described by Kuffler & Gerard were entirely located in the spindles and served to regulate the 'bias' on the stretch receptors. To examine this possibility, the M. ext. longus dig. IV of the frog was isolated together with its nerve, and recording electrodes were placed on nerve and muscle so as to obtain a simultaneous picture of electric muscle responses and afferent discharge. In some experiments the nerve supply was reduced by dissection until one or two sensory and one or two motor units remained.

(i) With stimulation of the low threshold motor axons, afferent impulses arise as early as 8 msec. after the muscle spike. This discharge is frequently still obtained during an intermediate stage of neuro-muscular block, when all perceptible motor responses have vanished. Thus the sense organ appears to be triggered by an extremely delicate mechanism which can be activated via branches of the ordinary motor axons. (ii) The occurrence of local responses of the muscle to stimulation of high-threshold fibres (Kuffler & Gerard, 1947) was readily confirmed. They are sometimes, but not invariably, followed by a sensory discharge. The fact that these local contractions can be obtained *without* change of the afferent discharge seems to eliminate the possibility that

they are an integral part of the spindle mechanism and lends support to the suggestion (see Kuffler & Gerard, 1947) that they serve some separate motor function.

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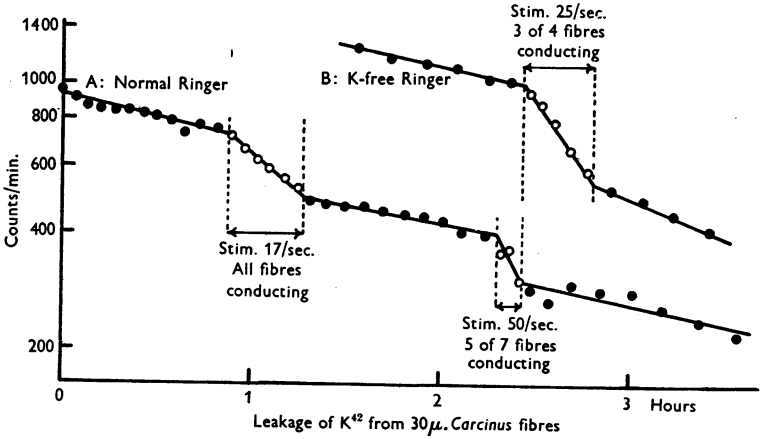
The leakage of radioactive potassium from stimulated nerve. By R. D. KEYNES. *George Henry Lewes Student, Physiological Laboratory, Cambridge*

Carcinus nerves were soaked for several hours in Ringer containing K^{42}, until they had taken up an appreciable amount of the radioactive ions. The nerve was then mounted in a thin-bottomed chamber over a Geiger counter, with its ends pulled up into a layer of paraffin oil so that stimuli could be applied and the action potentials recorded. The central part of the nerve was held down by glass hooks, and inactive Ringer was circulated continuously around it so that K^{42} ions did not contribute to the recorded radioactivity once they had leaked out. Under resting conditions the amount of K^{42} in the fibres then decreased exponentially, with an average half-time of 1·4 hr. for whole nerve, and 1·9 hr. for isolated 30 μ. fibres.



In the figure above it is seen that when the nerve was stimulated at 17 impulses/sec., the rate of loss of K^{42} was roughly tripled. In normal Ringer this might have been due either to an increased rate of exchange of K^+ ions, with no net loss of K, or to an actual leakage of K during stimulation. The fact that the same increased loss of K^{42} occurred in K-free Ringer, where there could be no exchange, suggested that there was a net leakage of K. This was confirmed by comparing the rates of entry of K^{42} into resting and stimulated fibres; at 50 impulses/sec. the rate was only increased to 1·3 times its resting value, whereas the corresponding increase in rate of leakage would be about 10 times.

The total amount of K inside the fibres which could exchange with K^{42} was found to be 206 mmol./l. axoplasm. Hence the amount of K lost during stimulation was calculated to be $2{\cdot}1 \times 10^{-12}$ mol./cm.^{2} membrane/impulse. This is comparable with the figure of $1{\cdot}7 \times 10^{-12}$ mol./cm.^{2}/impulse obtained by Hodgkin & Huxley (1947) for the same type of nerve by an indirect method, and supports the supposition that K does leak out during activity.

REFERENCE

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Slowly adapting touch receptors in skin from the rabbit's leg. By B. FRANKENHAEUSER (introduced by G. WEDDELL). *Department of Human Anatomy, University of Oxford*

An investigation has been made of the action potentials aroused in the sural (saphenous minor) nerve in the rabbit following natural stimulation of the skin in its distribution. So far it has been found that two different types of response

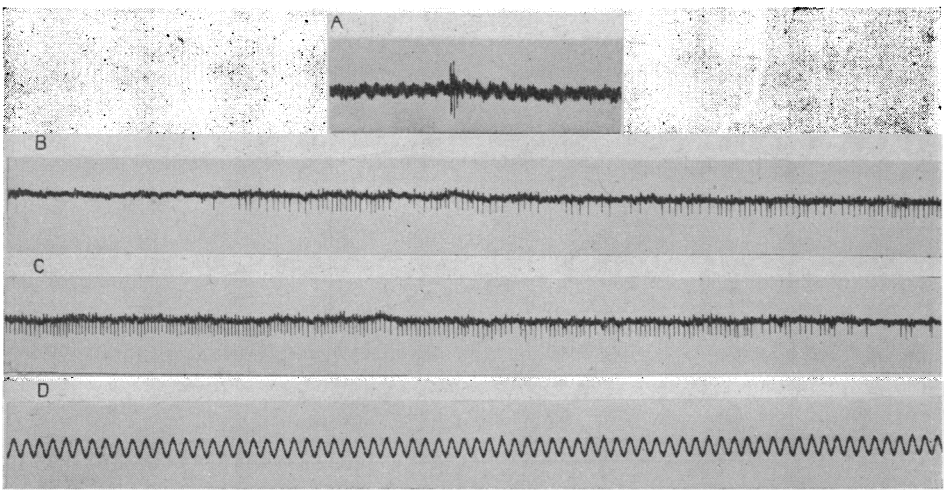


Fig. A. Action potentials from the sural nerve produced by bending a few hairs with a No. 1 nylon thread, and keeping the hairs in this position.

Figs. B, C. Record obtained when a slowly adapting receptor was touched with a No. 1 nylon thread. The increase in frequency followed an increase in pressure. B and C are continuous.

Fig. D. Time marking 50 cyc./sec.

can be recorded. The first of these has already been described by Adrian, and is derived from rapidly adapting hair touch receptors. The second, however, does not appear to have been previously noted, and consists of action potentials from receptors with a slow adaptation. Such potentials can be elicited by the stimulation of some four or five points per square centimetre of skin. This type of response cannot be aroused by bending the hairs, but only by stimulating

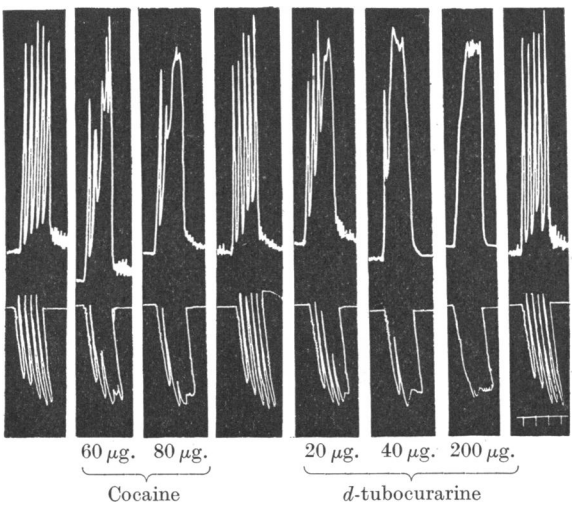
the actual skin surface, and if the skin is moved on the deeper tissues the points concerned are found to move with it. These receptors may be stimulated with a blunt rod, but their threshold is even less than the pressure of a No. 1 nylon thread (200 mg.; 0·15 mm. diameter). The discharge frequency is higher if higher pressures are used; the response stops as soon as the pressure or touch on the skin is removed.

The neurohistology of the skin in the points concerned in this response is under active investigation, but it is too soon to report results, except to note that Pacinian corpuscles do not appear to be responsible for this effect.

It is also of interest that if the nerve is blocked by means of a pressure cuff round the intact leg, the fibres conducting the action potentials from hair touch receptors are blocked five to ten minutes before the fibres conducting impulses from the slowly adapting receptors.

Inhibition of the peristaltic reflex as a method for assaying local anaesthetics and curare-like substances. By W. FELDBERG* and C. Y. LIN† (Chengtu). *From the Physiological Laboratory, Cambridge*

The peristaltic reflex was initiated in the isolated rabbit's ileum preparation by raising the pressure in the lumen (Trendelenburg, 1917). The reflex consists of



Rabbit's ileum preparation in 40 c.c. Tyrode solution. Upwards stroke of upper tracing shortening, lower tracing volume record of intestine. Time 30 sec.

a contraction of the longitudinal muscle, which is a muscular response to the stretching, and of contractions of the circular muscle initiated by a local nerve

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reflex. The contractions of the circular muscle, which are easily recorded with a volume recorder, are inhibited by local anaesthetics and curarine in doses too weak to affect the muscle directly. The inhibition is reversible and repeatable, and with increased doses graded responses are obtained. Inhibition of the reflex thus provides a simple method for testing the activity of these drugs. In a 40 cm. bath the threshold dose for *d*-tubocurarine was about 10 μg., for cocaine about 20 μg. Procaine was slightly less, borocaine 7 times less and nupercaine was about 12 times more active than cocaine; in addition, the effect of nupercaine lasted longer than that of cocaine after removal of the drugs.

The usual procedure adopted was to initiate the reflex every fourth minute by raising the pressure in the lumen to about 3 cm. saline and keeping it high for 1 min. The drugs were added 2 min. before, and washed out when the pressure was again lowered to zero. Between each test two normal control periods of peristalsis were allowed; with one exception they are omitted in the figure, which shows the initiation of the reflex and its graded inhibition by different doses of cocaine and *d*-tubocurarine. The contraction of the longitudinal muscle, however, is not inhibited.

REFERENCE

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