phase by shaking the clear supernatant with water and iso-octane. The catechols are removed by absorption on to alumina and recovered from it using perchloric acid elution. Following this they are extracted using an ion pairing compound dissolved in chloroform and then returned to an aqueous phase by shaking the organic layer with formic acid. The solution is evaporated to dryness and the amines reacted with trifluoracetic anhydride using methyl cyanide as the solvent.

The 5-hydroxytryptamine is recovered from the alumina supernatant by multiple extractions with a 20% v/v solution of n-butanol in diethyl ether, the resultant solution is evaporated to dryness, and derivatized in a similar manner to that described for the catechols.

The gas chromatography is carried out on a 5% SE-52, coated on 100–120 mesh Gas Chrom Q under temperature programmed conditions, and the derivatives are detected with an electron capture detector containing a nickel-63 source.

REFERENCE

ANSELL, G. B. & BEESON, M. F. (1968). Rapid and sensitive procedure for the combined assay of noradrenaline, dopamine and serotonin in a single brain sample. *Anal. Biochem.*, **23**, 196–206.

A solid-state iontophoretic current switch

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For microiontophoresis it is necessary to pass very small constant currents through glass microelectrodes. These currents are usually obtained by applying large D.C. voltages (up to 250 v) across resistances of high value in series with the electrode, and the switching of such voltages by mechanical devices can result in considerable switching artefacts which disturb the recordings.

The demonstration consists of a 4-channel Iontophoresis Current Switch, using high voltage transistors and powered by a common mains supply. Each channel is controlled automatically by logic, following a START command (which can be manual or by a start pulse), thus providing precisely timed drug applications and eliminating errors.

The switch uses three transistors only, in a simple circuit. An NPN transistor switches positive voltages and a PNP, negative; a third transistor acts as an emitter-follower, driving the PNP negative switching transistor. Both switches are controlled by a common positive input which is the output of the controlling logic circuit. Outputs from both positive and negative switching transistors are summed, the junction being wired to a high value resistor (500 MΩ) situated remotely, near to the preparation. This arrangement keeps the sensitive parts of the circuit short and minimizes noise due to interference.

The switch has one normal state; when the logic circuit output is " O ", the PNP transistor is switched " OFF " and the NPN transistor " ON ", and this results in a negative potential appearing at the summing junction. When " 1 " appears, the reverse happens, producing a positive potential at the junction. The normal state can be arranged by operating a switch, so that either positive or negative ions

can be ejected from the electrode. The potential appearing at the summing junction in the normal state provides the backing current.

The Current Switch (Figure 1) is normally used in conjunction with a 3-decade Counter (Bradley & Wolstencroft, 1964) which counts neuronal action potentials over preset sampling periods, referred to as epochs. The Counter produces a pulse at the end of each epoch (Epoch pulse). A single-decade counter is fitted to each channel of the Iontophoretic Current Switch and this counts the Epoch pulses; it can be preset to count any number of epochs from 1 to 9. The selected number of epochs is therefore preset on this counter and the START initiated.

On receipt of the first epoch pulse, the switch changes over, ejecting the drug for the number of epochs selected and, having attained this number, both epoch counter and switch are reset, re-establishing the required backing current.

The unit demonstrated has been used continuously over the past 18 months very successfully, freeing the experimenter from many tasks and providing precisely timed drug applications and accurate recording of data.

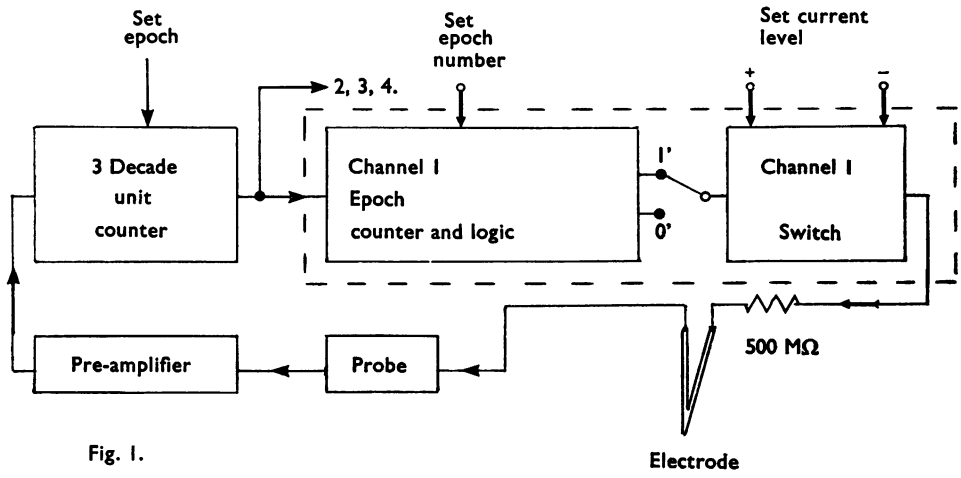

Fig. 1.

REFERENCE

BRADLEY, P. B. & WOLSTENCROFT, J. H. (1964). A counter and print-out unit for recording the frequency of neuronal action potentials. *J. Physiol. Lond.*, **170**, 2–3*P*.

An improved electrically operated microtap

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The original microtap was introduced by Comis, Evans & Whitfield (1964) as a means of applying drugs to single neurones. The microtap uses a concentric system of glass micropipettes, the outer one containing drug solution, while the inner one acts as a recording electrode and can also be used to block the tip of