DEMONSTRATIONS

A modular system of instruments for simple experiments on skeletal muscle using intracellular microelectrode techniques

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The apparatus to be demonstrated forms a basic system used routinely in three laboratories over the last five years. The system consists of a buffer amplifier, constant current generator, current monitor and differentiator. The circuits are essentially derived from those described by Clayton (1971).

The buffer amplifier employs a 748 operational amplifier with a dual field effect transistor (F.E.T.) source follower at the front end. It features input capacitance neutralisation and a facility for checking electrode resistance. The input impedance of the amplifier is of the order of 10^{12} ohms and a typical rise time of 60 μs is obtained when used with a 10 MΩ electrode connected to the amplifier via a 25 cm long low noise input lead.

The constant current generator consists of a high gain amplifier with a dual F.E.T. front end with two input and two feedback resistors connected to form a constant current generator. Additional transistor switching circuitry is employed to drive the generator at the required trigger voltages, enabling it to produce both steady and pulsed currents of up to ± 200 nA.

The timing of the pulse current is obtained by triggering the generator from two output sockets of a Digitimer Constant Voltage Generator.

A capacitance neutralization amplifier similar to the buffer amplifier is also built-in enabling the user to square up the stimulating current pulse and to monitor the condition of the microelectrode. An electrode resistance measuring facility is also employed.

The current monitor is also a high gain amplifier with a dual F.E.T. front end with a single feedback resistor. Connected this way the circuit forms what is commonly known as a current to voltage converter, producing a voltage output directly proportional to the current being monitored.

The differentiator circuit is typical of 'active' differentiating circuits for measuring the rate of rise of action potentials and is meant to be driven from the low output impedance socket of the buffer amplifier. It features an input impedance of 1 MΩ and will give an output of 1 V maximum for rates of rise of either 0–1000 V/sec or 0–10 V/seconds.

The apparatus is constructed as a modular system allowing considerable flexibility in use. It is easily assembled and has a total component cost of approximately £250. A full description of the circuit is available.

Reference

CLAYTON, G.B. (1971). *Operational Amplifiers*. London: Butterworths.

A modified guinea-pig stomach preparation

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Several isolated preparations have been used to investigate the motility of the guinea-pig stomach (for references see Beani, Bianchi & Crema, 1971) but all these preparations were relatively insensitive to relaxant drugs and the relaxations were slow in onset. In the isolated preparation demonstrated, these problems have been overcome by injecting drugs into the vasculature of the stomach, via the coeliac axis.

Female guinea-pigs (250–400 g) were starved for 24 h before being killed by cervical dislocation. The vagal nerves were located and dissected clear of the oesophagus, which was ligated. The coeliac axis was cannulated before the stomach was removed from the animal; the spleen was ligated and removed, ensuring that the blood supply to the greater curvature of the stomach was intact. A bulk ligature was tied around the fat surrounding the hepatic artery and the pancreatic and duodenal artery was ligated. Freshly oxygenated McEwen's solution (4 ml) was slowly injected through the vasculature. The stomach, with the cannula attached, was then removed from the animal and a hole cut in the fundus to wash the lumen clear of chyme. The tube of a modified Trendelenburg apparatus was tied into the fundus, the pylorus was ligated and the preparation set up in a 100 ml isolated organ bath filled with McEwen's solution maintained at 35 ± 1°C, gassed with 95% O_2: 5% CO_2. The tube of the apparatus was connected to a reservoir of McEwen's solution; the level of fluid in the reservoir was initially set 3 cm above the fluid level in the organ bath. Air pressure over the reservoir was measured using an Ether UPI air pressure transducer and a Devices M2 recorder.