A COMPUTER-ASSISTED LEARNING PROGRAMME FOR TEACHING THE ELECTRO-CARDIOGRAM TO SCIENCE UNDERGRADUATES

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A number of interactive computer-assisted learning (CAL) programs have been reported in recent years for undergraduate teaching in pharmacology and physiology (Clarke, 1986; Dewhurst & Meehan, 1986; Hughes, 1987; Brown & Dewhurst, 1987). Such programs are being increasingly used either to supplement, or in some instances as alternatives to existing teaching methods.

Here we describe a CAL program, produced for the BBC microcomputer, based on the electrocardiogram (ECG). The program is menu-driven and is written in a combination of BASIC and assembly language. High-resolution simulations of ECG waveforms are presented on a continuously scrolling screen display to simulate a chart recorder. The moving display can be paused to allow students to take measurements of individual traces, (using the on-screen vertical ruler and timescale provided), and hard copy printouts can be obtained. The program includes introductory text describing the physiological basis, interpretation, and method of recording of the ECG and shows typical recordings from both bipolar and unipolar electrodes, using data obtained from healthy subjects to generate the simulations.

Also included is a description of a method of calculating the approximate cardiac vector (mean electrical axis of the heart) after Green (1975), and a menu option which allows students to input their own measurements and uses these to calculate this angle.

The availability of only a minimum of hardware is assumed: BBC B or Master microcomputer, monochrome monitor, single 40 track disk drive and an Epson-compatible printer if hard copies are required. The program has been used successfully in our own department by students on a variety of biology/health-related courses.

Brown, G.J. & Dewhurst D.G. (1987) Br.J. Pharmac. 92, 790P.
Clarke, K.A. (1986) J. Physiol. 376, 8P.
Dewhurst, D.G. & Meehan, A. (1986) Br. J. Pharmac. Proc. Suppl. 89, 882P.
Green, J. (1975) Introduction to Human Physiology, Oxford University Press.
Hughes, I.E. (1987) Br. J. Pharmac. (1987) 90, 290P.

AUTOMATED ANALYSIS OF DRUG-INDUCED CONVULSIONS USING BBC MICROCOMPUTER

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The system used is a modified version of that described by Angel (1970) to measure drug-induced changes in total locomotor activity in mice. Briefly, anaesthetised or non-anaesthetised mice are placed in a perspex container suspended from a rigid beam on which are mounted two strain gauges (Washington Series 400 D1-3). These strain gauges are connected with two fixed-value resistors in a Wheatstone Bridge arrangement. Changes in the force applied to the beam, due to animal movements, produce changes in the bridge output voltage.

Signal conditioning and amplification is provided by a strain gauge amplifier (RS components) and a bandwidth limiting amplifier connected to the output of the sensor amplifier provides anti-aliasing protection. This is a fourth-order Butterworth filter with a 3 dB point at 50 Hz and is constructed using standard operational amplifiers. The filtered signal is fed into the analogue port of a BBC model B microcomputer. A diode protection circuit is used at the input to the analogue port, since the maximum allowable voltage is 1.8 V.

The software allows the analogue port to be sampled as often as possible, integratred over a user-defined pre-set time period and stored on disk. The stored data can then be analysed eg.the area of the drug-induced response can be calculated. Drug-induced changes in locomotor activity can be displayed on the monitor or output to a printer.

The demonstration will illustrate the analysis of catechol-induced convulsions. However, the versatility of the software, which allows the user to define parameters such as the total duration of the recording and the time over which the input is integrated, makes the system suitable for analysing convulsions induced by a variety of agents.

Angel, A. (1970) Br. J. Pharmac. Proc. Suppl. 39, 243P.

A COMPUTER-ASSISTED LEARNING PROGRAM FOR TEACHING NEUROMUSCULAR PHARMACOLOGY TO UNDERGRADUATES

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A number of computer-simulation programs have been produced to assist in undergraduate teaching of pharmacology (Hughes, 1982; 1987; 1988). These programs can be used either to improve the preparedness of students before they perform the experiment or in some cases, particularly where the preparation to be used is expensive, as alternatives to the experiment itself. One such example is the in vivo investigation of the pharmacology of neuromuscular transmission using the sciatic nerve-tibialis anterior muscle of the cat. Here we describe a computer-assisted learning program which simulates experiments which can be performed on this preparation.

The program, which is menu-driven, is written in a combination of BBC BASIC and assembly language and is designed to require only the minimum of hardware: BBC B or Master microcomputer, single 40 track disk drive, monitor and, if hard copy printouts are required, an Epson-compatible printer. The first two menu options introduce students to the physiology and pharmacology of neuromuscular transmission, using animated graphics, and describe the preparation and experimental protocol. Most of the other menu items present students with simulated experimental results to enable them to differentiate between the actions of both depolarising and non-depolarising neuromuscular blocking agents. These results are presented in accelerated time (recorded by an on-screen clock) on a continuously moving screen display to simulate a chart recorder, and can be simultaneously output to a printer. The actions of known drugs on muscle twitches evoked by stimulating the nerve at either 0.1 Hz, or with a tetanus and by intra-arterial injection of acetylcholine are shown using data derived from actual experiments to produce the simulations.

The final section requires students to characterize the action of different types of neuromuscular blocking agents by completing a table, and summarises the clinical actions of such drugs. The program can then be easily extended to include the identification of unknown drugs where students are given the freedom of designing an experimental protocol for a known drug and then comparing its action to that of an unknown.

Hughes, I.E. (1982) Br.J.Pharmac. 75, Proc. Suppl., 171P
Hughes, I.E. (1987) Br.J.Pharmac. 90, Proc. Suppl., 290P
Hughes, I.E. (1988) Br.J.Pharmac. Proc. Suppl., (in press)