viding continuous monitoring of the fluid level ('drug concentration') in the plasma compartment. The record could be in either linear or logarithmic mode to demonstrate bi-exponential kinetics and the influence of various parameters including a simulation of displacement of a drug from plasma protein binding.

(c) A shaking table on which ball-bearings set in random motion were used to show:

(i) how binding (on magnets) would affect the free concentration and therefore the apparent volume of distribution of a substance.

(ii) the effect of barriers to diffusion on concentration, and the differences of distribution of two substances represented by two sizes of ball bearing.

These models, together with conventional demonstrations of diffusion and protein-binding of a dye and a simple computer simulation, are demonstrated in a videotape prepared by the student group. The students who prepared the models and the videotape experienced considerable benefit from the task. This tape is expected to be a helpful supplementary source for 1st year and 2nd year students studying elementary pharmacokinetics.

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A microprocessor-based simulator for teaching pharmacokinetics

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The simulation of the change of plasma drug concentration with time by dye-dilution (Jansen, 1977) or by electrical analogue (Danek, 1976) models has been found to be a useful teaching aid in the explanation of clinical pharmacokinetics, such as that described by Gray & Lasseter (1976), in that they do not seek to find the best solution to the data in compartmental and rate terms, but merely to illustrate the consequences of change in a few important parameters. Restriction to an elementary system with a limited number of parameters allows the student to appreciate some basic concepts in pharmacokinetics such as effects of change of dose size, dosing interval, apparent volume distribution and absorption and elimination rate constants.

An inexpensive and portable simulator based on the Intel 8080 microprocessor has been used for the teaching of pharmacokinetics to medical students. The simulator was constructed from a "Pocket teletype" keyboard (G.R. Electronics Ltd.), an Intel SDK 80 microprocessor kit, a digital/analogue converter (Signetics NE 5018) and a laboratory potentiometric recorder. A table of exponential values is stored in 256 bytes of a 1 k byte, read-only, (EPROM) memory. A single compartment model of the type:

$$Cp(t) = CPo\,(e^{-k_{el}t} - e^{-k_a t})$$

where

$Cp(t)$ = concentration of drug in plasma
Cpo = theoretical concentration at the moment of injection
K_{el} = Elimination rate constant
K_a = Absorption rate constant
t = time in hours

requires the computation of two exponential values which are taken by the program from values stored in the table. The machine produces an output corresponding to 8 min or real time at 1 s intervals or less, and continues until the values of the exponentials have both decreased to less than one unit. The output is displayed on a standard potentiometric recorder with a f.s.d. of 10 volts. The programme is able to run at speeds of between 60 and 6000 times real time, thus allowing a complete 24 h simulation to be displayed in less than one minute. The program is stored in the remainder of the 1 K EPROM.

Multiple dosing may be illustrated by pressing any key of the pocket teletype whilst displaying a run, a second dose is then added to the residual concentration and the output displayed accordingly.

The simulator is easy to use and has found ready acceptance by students for self instruction. Moreover, the nature of the model could be made more complex, by reprogramming the microprocessor to take account of more compartments, as future needs demand.

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True/false units of assessment in physiology and pharmacology

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In our assessment of students in physiology and pharmacology, true/false items make up 25% of the total credit for Part 1 of the B. Med. Sci. course (2 years). They normally take the form of a series of statements requiring a decision on whether each is true or false; students may abstain. The decision is recorded by marking a box opposite the statement. The statements are designed to test factual knowledge, grasp of general principles, interpretation or problem solving ability.

The students' responses are processed using an optical mark reader (Data Recognition DT3) and a DEC PDP 11/35 computer. The computer print-out gives details of each student's performance on each statement and also provides information on the mean mark for each statement and the proportion of right and wrong responses and abstentions. The proportion of students in the top quartile (on the basis of the total mark for the 50 item test) and the proportion in the bottom quartile giving a correct response is given for each statement (cf. Crow, Diament & Goldsmith, 1969; Paton, Stanley-Jones & Bell, 1971). From these data a retrospective assessment of the severity and predictive ability of each item may be made. Adverse item characteristics, for example, high abstention rate with poor predictive ability, may indicate defects such as ambiguity in the item text. If the text itself confirms this, the item may be deleted from the test analysis and amended in the item bank.

True/false statements are banked on individual cards together with their computer print-outs for the previous occasions on which they have been used. The cards are laid out so that a sequence can be overlapped for copying on a Xerox machine, avoiding transcription errors. These cards also carry explanations of the correct responses to the statements; the statements, correct responses and explanations are displayed publicly for some days after the assessment has been taken. We believe this opportunity for feedback enhances the educational value of assessments.

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Diuretic testing

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