Programmed learning and long-term retention

SIR,—In a previous report (Foy, 1965) of an experiment using a programmed text for teaching physiology to first year undergraduate pharmacy students, it was concluded that students who read the programme were at no disadvantage either in learning time or amount learned, compared with those who followed a lecture on the same material. The results have since been confirmed with another group of students using an experimental programmed text on the control of respiration.

However, the results of examinations taken 4 months later suggested that students who had taken the programme enjoyed some advantage in the relevant sections of the papers over students in the lecture group—assuming that the two groups did not differ in the amount of explicit rehearsal of the material between the previous test and the examination. To test this suggestion, a second experiment was made. As in the first experiment (Foy, 1965), one group of students used a programmed text while the other group attended a lecture, the subject being "Control of Respiration". Also as before, certain experimental precautions (Cheris, 1964) were taken; the content to be learned was identical for each group, presentation was optimal, learning conditions were controlled and criterion testing was unbiased.

The first objective test was given 72 hr after the learning session. Students had notice of this test, and each group was asked not to collaborate in preparation with the other. A second, identical test was made after an interval of 7 weeks. For this test the students were given no notice, neither was any reference made to the investigation during the interval. The results of the two tests appear in Table 1. After the scores had been adjusted on the basis of a

TABLE 1. RETENTION OF MATERIAL LEARNED FROM LECTURES COMPARED WITH THAT FROM A PROGRAMMED TEXT

	Programme group	Lecture group
1. Students present at all 3 tests	32	32
2. Mark from previous objective test in physiology (60 possible); mean ± s.e.	29·7 ± 1·0	32·3 ± 1·0
3. Mark from test on respiratory control taken 72 hr after learning session (40 possible); mean ± s.e. ..	17·7 ± 0·9	19·7 ± 1·0
4. Mark from test on respiratory control taken 7 weeks after learning session (identical test); mean ± s.e. ..	13·9 ± 0·7	12·3 ± 1·0
5. Difference between 3 and 4	3·8 ± 0·9*	7·3 ± 0·9*
6. Number of students admitting to revision during retention interval	4	3

* Significant difference P = 0·99.

previous objective test in physiology (cf. item 2, Table 1) there was no significant difference between the performance of the two groups in the first test. However the "programme" group was significantly superior in the delayed retention test. As an approximate check on the assumption of no differential rehearsal between the groups, all the students were asked how much revision of the material they had done in the interval. As can be seen from Table 1 revision was minimal and balanced between the groups, so this does not seem to have been a significant factor. In fact, when the retention test data were re-examined after removal of the revising students' scores, there was no appreciable difference in the magnitude of the discrepancy between the two groups.

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Importance of noradrenaline synthesis for the interaction between desipramine and reserpine

SIR,—We have previously reported that the hyperthermic effect induced by desipramine in rats given reserpine may be inhibited by peripheral adrenergic blocking agents (Jori, Paglialunga & Garattini, 1966) and by α-methyl-*m*-tyrosine (Garattini & Valzelli, 1961), an agent which depletes brain noradrenaline stores (Hess, Connmacher, Ozaki & Udenfriend 1961; Gessa, Costa, Kuntzman & Brodie, 1962).

These results suggested that imipramine-like drugs might antagonise the reserpine hypothermia by interacting with the adrenergic system. In fact, an increase of the concentration of noradrenaline at the receptor sites might be expected as a consequence of the inhibitory action of desipramine on the catecholamine re-uptake at the nerve endings (Iversen, 1965).

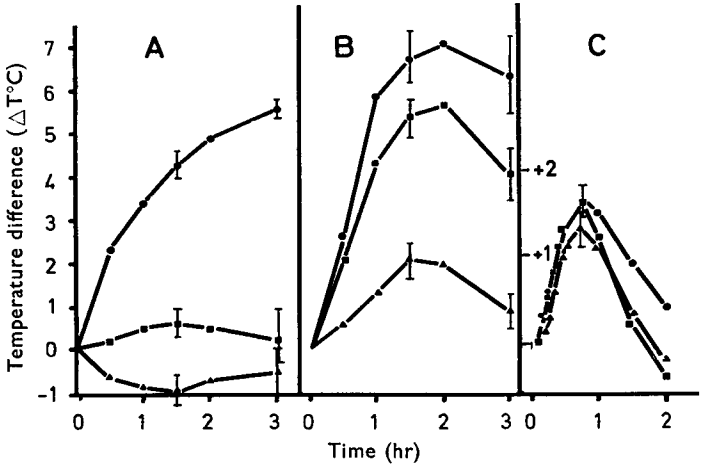

FIG. 1. Hyperthermic agents (desipramine, dopa and noradrenaline) were given at zero time, 18 hr after reserpine and 2 hr after the enzymatic inhibitors (α-methyl-*p*-tyrosine and diethyldithiocarbamate). Each point represents the average of 8 rats. The vertical bars indicate the standard errors. A. ●——● desipramine (7·5 mg/kg i.p.). ■——■ α-Methyl-*p*-tyrosine (80 mg/kg i.p.) + desipramine. ▲——▲ Diethyldithiocarbamate (300 mg/kg i.p.) + desipramine. B. ●——● Dopa (150 mg/kg i.p.). ■——■ α-Methyl-*p*-tyrosine + dopa. ▲——▲ Diethyldithiocarbamate + dopa. C. ●——● Noradrenaline (300 μg/kg i.v. in 15 min.). ■——■ α-Methyl-*p*-tyrosine + noradrenaline. ▲——▲ Diethyldithiocarbamate + noradrenaline.