and total NA content (Martins & Valle, 1939; Wakade *et al.*, 1975; Sjostrand & Swedin, 1976). It is, therefore, concluded that the effects of motor nerve stimulation and of NA on rat vas deferens are normally under the control of testosterone and that this should be borne in mind when using this tissue to analyse adrenergic mechanisms.

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Behavioural studies in the monkey (*Macaca mulatta*) with sotalol and with (+)-, (±)- and (−)-propranolol

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In a previous study Clancy, Nicholson & Wright (1977) described the effect of metoprolol and oxprenolol on delayed differentiation behaviour in the monkey. Accuracy of response was impaired over the dose range (5–30 mg/kg), and with 20 mg/kg and above total response time was increased. In the present paper we have extended these studies to sotalol and to (+)-, (±)-, and (−)-propranolol.

Five male monkeys (*Macaca mulatta*) of mean body weight 11.6 kg were used. The task (Nicholson, Wright & Ferres, 1973) involved the recognition of like and unlike pairs of visual stimuli, and the monkeys were required to press a lever if the stimuli were like and to refrain from pressing the lever if the stimuli were unlike. Each monkey was tested after the intraperitoneal injection of 5, 10 and 15 mg/kg of each isomer of propranolol hydrochloride, and 5, 10, 15 and 20 mg/kg sotalol hydrochloride. The drug vehicle (saline) was injected on four occasions. A random order of injection was used, and each injection was separated by at least 7 days. Performance was tested 1 and 4 h after injection. The data were analyzed by analysis of variance with reference to the overall effect of the drugs over the dose range, and the effect of individual doses of each drug.

It was not possible to differentiate between effects on total response time (TRT). Over the dose range 5–15 mg/kg the increase at 1 h for each drug was similar ($P < 0.01$), and there were no effects at 4 hours. Increase in TRT was dose related. With 15 mg/kg of each isomer of propranolol the increase at 1 h was very highly significant ($P < 0.001$), and with (−)-propranolol persisted to 4 h ($P < 0.05$). With 20 mg/kg sotalol the increase was very highly significant ($P < 0.001$) at 1 and 4 hours.

Accuracy of response was impaired over the dose range 5–15 mg/kg with sotalol ($P < 0.05$), (+)-propranolol ($P < 0.01$) and (±)-propranolol ($P < 0.001$), and with (+)-propranolol persisted to 4 h ($P < 0.01$). Impaired accuracy was related to dose. With 10 and 15 mg/kg (+) and (±)-propranolol the effect was highly significant ($P < 0.01$), and with 15 mg/kg sotalol the effect was significant ($P < 0.05$). With (−)-propranolol accuracy was not impaired over

the whole dose range, though the effect of 15 mg/kg was significant ($P < 0.05$). With sotalol accuracy was impaired over the dose range 5–20 mg/kg at 1 h ($P < 0.001$) and at 4 h ($P < 0.05$). The effect with 20 mg/kg was highly significant ($P < 0.01$) and persisted to 4 h ($P < 0.05$).

From these and the previous study (Clancy *et al.*, 1977) it would appear that, with the antagonists studied, (−)-propranolol and sotalol have the least effect on accuracy of response, and metoprolol and oxprenolol have the least effect on total response time. β-adrenoceptor antagonists may have differential effects on the nervous system, and impaired accuracy and increased response time may represent central and peripheral effects of these drugs.

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The effects of piracetam on acquisition and retention of habituation

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Piracetam has been found to improve the performance of animals in several learning and memory tests (Giurgea, 1972, Bryant, Petty & Byrne, 1973, Sara & David-Remacle, 1974, Wolthius, 1971). In the present study we have investigated the effects of this drug on short and long term habituation (i.e. the progressive response decrement to repeated stimuli).

Exploration and its habituation were tested in a 4-hole holeboard (File & Wardill, 1975) and in this experiment, rats were injected (i.p.) daily with piracetam (100 mg/kg) or saline 30 min before testing. They were placed singly in the holeboard for 10 min, at the same time of day, every day, for ten days. The time spent head-dipping and the level of motor activity were recorded automatically. The control animals exhibited the characteristic response of a reduction in head-dipping between days (between day habituation) until a baseline was reached. Piracetam did not affect motor activity but it prevented between day habituation. This meant that the initial level of exploration was higher with piracetam on each day and although there appeared to be greater within-session habituation, this may have been due to the higher initial levels.

In order to study within-session habituation, we chose a task in which discrete trials were under the control of the experimenter. Tones were presented to rats until an habituation criterion was reached of 3 successive tones causing no distraction. It was found that piracetam treated animals habituated significantly faster i.e. took fewer trials to reach criterion on the first day than did the controls. On retest, one week later, the control animals showed a significant reduction in trials to criteria revealing retention of the previously learned information, whereas piracetam treated animals showed no retention.

Thus, whilst piracetam produces faster habituation within a session, it impairs 24 h retention of habituation of exploration and one week retention of habituation of distraction.

Sara & David-Remacle (1974) have suggested that piracetam enhances acquisition in tasks which take place over a series of days by facilitating retrieval of partially learned responses. Our findings suggest that the time interval over which piracetam may exert its facilitative effects is task dependent and that variations in time intervals may result in impairment of retention.

The pattern of results obtained with piracetam will be compared with results obtained in these tests with other drugs in an attempt to characterize the actions of piracetam.

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