Disruption of position habit reversal by septal stimulation¹

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Abstract

Ss receiving mild continuous septal stimulation did not differ from normals in water intake or in the learning of a thirst-motivated position habit. They did however, show an impairment in ability to reverse the position habit.

Problem

Continuous low level electrical stimulation of the septal area has been shown to impair the development of passive avoidance in a water-shock conflict situation (Kasper, 1964; Kasper & Pellegrino, 1965; Schwartzbaum & Donovanick, 1965). The following experiments were designed to examine the possibilities that the passive avoidance impairment is related to (a) increased thirst, (b) general learning deficit, (c) decreased ability to inhibit ongoing responses, or (d) a rewarding effect of the septal stimulation.

Subjects

Ss were 33 male hooded rats. Twenty of these were implanted with stainless-steel electrodes ending in the lateral septal region. The remaining 13 Ss served as controls.

Procedure

Water intakes were measured during 15 min. sessions on 12 consecutive days, while the Ss were 23-1/4 hr. water-deprived. Test sessions took place in small wooden cages equipped with calibrated drinking tubes. Ss were then returned to their home cages where after 15 min. they received water for an additional 15 min. These conditions were similar to those used in Kasper's (1964) passive avoidance study.

Ss were divided into 3 groups: Group C consisted of 13 unstimulated controls, Group EI of 11 Ss stimulated during test sessions on days 5, 7, 9, & 10, and Group EII of 4 Ss stimulated on days 5, 6, 7, & 8. The brain stimulation was supplied by a Grass S4 stimulator at 20 μ a, 0.5 msec., 100 cps, and was continuously monitored on a Fairchild 704 oscilloscope (Kasper, 1964; Schwartzbaum & Donovanick, 1965).

Following testing on water intake, 8 Ss from Group C, and 13 (Group E) from Groups EI and EII were trained on a position habit. The apparatus consisted of a 6 x 13 x 12 in start box opening via swinging doors into two identical 18 x 6 x 12 in runways each containing a 0.25 ml water cup. Illumination was provided by two No. 47 pilot bulbs, one over each cup.

Daily sessions of 20 trials with 30 sec. intertrial intervals were given. On the first learning trial the incorrect runway was blocked. First-trial latencies were recorded for 5 Group C Ss and 8 Group E Ss. On

Fig. 1. Water consumption of 23-1/4 hr. water-deprived rats.

the second session a wooden barrier 3 in high and 1/2 in wide was introduced between the start box and runways in order to slow the Ss at the choice point. As Ss reached the criterion of 80% correct responses on 3 consecutive days, the correct side was reversed.

Following testing on position habit learning and reversal, 6 Group E Ss were tested in a runway (not reported here). Then 4 of these were given six 10 min. sessions in a modified Valenstein box (1964) to determine the motivational significance of the type of brain stimulation used throughout testing (20 μ a, 0.5 msec., 100 cps).

Three Ss, not tested on any of the above, received constant septal stimulation for five 24 hour periods to determine whether such stimulation would affect home cage water intake in nondeprived animals. Their intakes under normal conditions were measured for one day before and one day after stimulation.

Results and Discussion

Continuous low level septal stimulation did not appear to increase water intake either in 23-1/4 hr. deprived Ss or in nondeprived Ss (Figs. 1 & 2). These findings, particularly the latter, are of interest in view of Harvey & Hunt's (1965) finding that septal lesions increase

water consumption. There appeared to be a tendency for water intake to decrease slightly when stimulation was turned either on or off (Fig. 1, Group EII; Fig. 2); this seems to be a distraction effect.

Septal stimulation did not interfere with the initial learning of the position habit (Mann-Whitney U test, $U = 34.5$), the range for both groups being 1-5 sessions exclusive of criterion sessions. However, stimulation did increase the number of sessions required to successfully reverse the position habit, $p < .02$, two-tailed (Mann-Whitney U test), as shown in Fig. 3. This resembles Zucker & McCleary's (1965) finding that cats with septal lesions require more training to reverse a position habit, and fits well with McCleary's (1961) response-inhibition hypothesis.

During original learning, stimulated Ss showed much shorter first-trial latencies than controls, $p = .015$ (Mann-Whitney U test), with a mean of 50 sec. as compared with the control mean of 143 sec. This "boldness" shown by stimulated Ss can be compared with the "boldness" shown by septal lesioned rats in leaving their home cages for an open-field (Thomas et al, 1959).

The Ss tested in the modified Valenstein box showed no signs of learning to either follow or avoid the stimulation, spending about 50% of each session with the stimulation on.

It is of interest that Ss stimulated in the lateral septal region behave as lesioned Ss do on passive avoidance (Kasper, 1964; McCleary, 1961), position habit reversal (Zucker & McCleary, 1964), and "boldness" tests (Thomas et al, 1959), while they do not show the increased water consumption (Harvey & Hunt, 1965) or the well-known hyperirritability of lesioned Ss.

Much of the behavioral data here described can be encompassed by McCleary's (1961) notion of impaired

Fig. 2. Water consumption of rats receiving continuous septal stimulation in a home cage environment.

ability to inhibit ongoing responses. However, the findings that septal lesions increase water intake (Harvey & Hunt, 1965), and that septal stimulation, and lesions greatly alter pituitary-adrenal function argue strongly for an important role of the septal area in general metabolism, and caution against oversimplification (Endroczi, 1963; Usher et al, 1965).

Fig. 3. Individual scores on number of sessions to reversal of the position habit (exclusive of criterion).

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Note

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