rump and flanks by the observer, as a further test for the presence of lordosis. On the basis of this two-stage screening procedure, the females were selected for further observation on oestrous and anoestrous test days, defined as follows: (*a*) oestrous test day—oestrous behaviour in the absence of contact stimulation was observed for the third consecutive day; (*b*) anoestrous test day—all signs of oestrous behaviour, both in the absence of contact stimulation and in response to manual stimulation by the observer, were absent for the fourth consecutive day. Each female was given mounting tests on four oestrous test days, each from a different oestrous cycle, and four anoestrous test days. For these tests, the female was placed for 1 h with a group of fourteen cats, of whom three to five were oestrous females, six to eleven were females showing no signs of oestrous behaviour, and none to three were adolescent males and females between three and seven months old. If the required number of oestrous females was not naturally available in the colony, oestrogen-treated females showing the full pattern of oestrous behaviour were used. During the mounting tests, the performance of any components of male-like mounting behaviour by the test females was recorded, together with details of the age, sex and oestrous condition of the cat towards which the mounting behaviour was directed.

Ten of the eleven females in the group performed elements of the male mounting sequence. With the exception of the "chirp" call given by males before mounting, all the components which lead to intromission by the male were seen[4]—that is, neck-grip, partial mount, full mount, forelimb rubbing, hindlimb stepping, arching of the back, stamping on the mounted cat's rump (a pattern seen in males which increases the elevation of the female's perineal region during lordosis), and pelvic thrusting. Four of the females never progressed beyond the neckgrip and partial mount. Pelvic thrusting was seen in only three females, and had a lower frequency than is usual in males. There was considerable inter-individual variation in mean mount durations (3–414 s).

The orientation of the behaviour with respect to the mounted cat was sometimes bizarre, and in such cases the position of the "neck-grip" varied considerably. Mounting from the side and front was seen, as well as the normal posterior mounting. In mounts from behind, the mounting cat often had its pelvic region well forward on the back of the mounted cat, and occasionally during prolonged mounts the mounting cat would slide off and lie on its side, maintaining a neck-grip and continuing to clasp the mounted cat with its four paws. These poorly orientated mounts are reminiscent of descriptions of mounting by male cats in which the dorsal nerves of the penis have been sectioned[5].

There was a clear relationship between mounting behaviour and the oestrous condition of the mounting cat. The twenty-two test periods in which mounting occurred were all oestrous tests, and for the group as a whole there was a highly significant tendency for mounting to occur in oestrous rather than anoestrous tests ($P = 0{\cdot}002$, two-tailed sign test[6]). Furthermore, of the thirty-seven cats which were mounted, thirty-one were in natural or induced oestrus, five were females showing no sign of crouching or treading and one was an adolescent male. For the group as a whole, there was a highly significant tendency for mounting cats to choose to mount oestrous females ($P = 0{\cdot}001$, one-tailed sign test). The mounting female was an adequate stimulus to produce the full pattern of crouching, treading and tail-deflexion in the oestrous cat being mounted, but no after-reactions were observed, presumably because they are specific to vaginal stimulation resulting from intromission.

The predominant selection of oestrous females by the mounting cats may simply reflect the fact that other females will not tolerate being mounted, for it is known that the female cat will accept only a male at the height of oestrus[3]. Alternatively, stimuli from an oestrous cat may be specifically responsible for eliciting mounting by other females. During the tests, groups of oestrous females commonly consorted together, sniffing at each others' perineal regions, and engaging in mutual head and neck rubbing while treading. Pairs of oestrous females would roll on the ground, clasping each other, and would engage in prolonged bouts of mutual genital stimulation by crouching back-to-back, treading and rubbing their perineal regions together. Mounting episodes were frequently seen during these periods of head-rubbing and genital stimulation. Furthermore, a mounting female was frequently immediately mounted by the cat she was mounting, or by another oestrous female.

On the basis of these observations it appears that, in appropriate conditions, mounting behaviour forms a prominent part of the spectrum of social behaviour among female cats. It occurs at oestrus and is directed preferentially towards other oestrous cats. The conditions appropriate for the appearance of homosexual mounting behaviour in females have previously been investigated in detail in the guinea-pig, rat and dog. It seems that the cat may be somewhat more selective in its choice of objects to mount than are rats[7] and dogs[8], and, unlike these species but in common with the guinea-pig[9], it shows a tendency to restrict homosexual mounting behaviour to periods when circulating ovarian hormones are at a high level.

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## Lack of a Long-term Effect of LSD on Y-maze Learning in Mice

It has recently been reported that lysergic acid diethylamide-25 (LSD) has an inhibitory effect on T-maze learning in mice[1]. The animals were tested 2 min after an intraperitoneal injection of LSD, in view of the observations of Uyeno and Benson that the effect of LSD on agonistic behaviour approaches a maximum 5 min after injection[2]. Because of the controversy regarding potential long-term psychological effects of LSD, we had undertaken an examination of the effect on learning a shock avoidance task by repeated treatment of mice with increasing quantities of LSD over a long period. We report here the effect of this regimen on Y-maze learning in mice.

Twenty-four male mice of the NIH strain, 1 month old initially, and weighing 25 g, were given a series of sixteen subcutaneous injections of LSD (Sandoz batch 65001) at evenly spaced intervals over a period of 2 months. The first dose, administered when the mice were 30 days old, was 2·5 μg of LSD per mouse dissolved in 0·1 ml. of isotonic saline solution. The dosage was gradually increased to a maximum of 12·5 μg per injection, so that each mouse received a total of 111·25 μg of LSD. Twenty-four

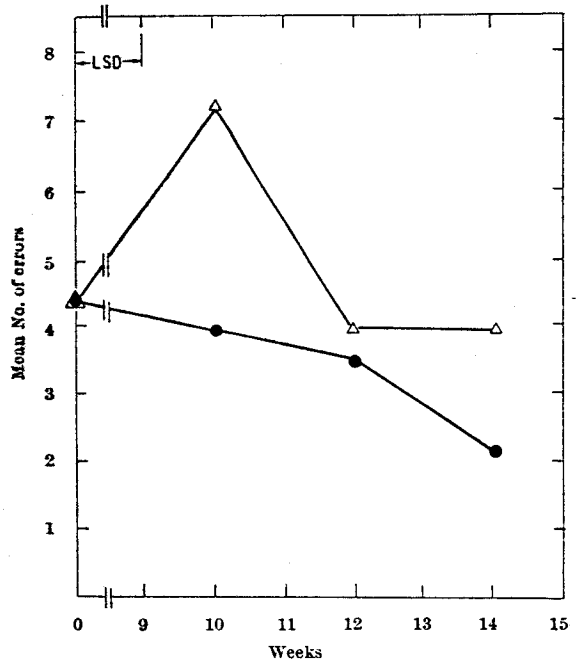


**Fig. 1.** Mean of errors in Y-maze learning of LSD-treated (△) and saline injected control (●) groups of mice.

age-matched controls were simultaneously injected with 0·1 ml. of saline solution. The mice were kept continuously from the beginning of the injection period in individual plastic cages and fed a standard commercial diet (Purina Lab Chow pellets) with water *ad libitum*. The mice which received LSD showed striking behavioural changes compared with the control animals. They were hyperactive for a period of several hours following each injection of the drug. They burrowed and tunnelled vigorously, climbed onto the spouts of the water bottle, ran inverted along the tops of the cages, and were found to be extremely aggressive in the presence of other mice.

Before administration of LSD, all forty-eight mice were tested for their ability to learn an avoidance task in the standard Y-shock apparatus described by Cardo[3]. This apparatus is a three-armed enclosure with hinged doors and a 1 cm × 1 cm wire grid over the wooden floor. The voltage applied to the grid is adjusted by a variable transformer and the operator can control the choice of exit arm by an electrical switching device, to eliminate the effect of possible bias on the part of the test animal. The mean number of errors at the time of original testing was $4·3 \pm 0·6$ s.e. (Fig. 1). The mice were then divided into two groups of equal learning ability and injected with LSD in saline or saline alone as described. The mice were re-tested 1 week after cessation of administration of LSD, by which time the signs of hyperactivity had disappeared. The mice which had received LSD showed an increase in the mean number of errors in the avoidance task to $7·0 \pm 1·03$ s.e., whereas the mean of the errors of the saline control group had decreased slightly to $3·9 \pm 1·09$ s.e. The difference between these groups is significant ($P = 0·02$–$0·05$) (ref. 4). The mice were tested 2 weeks later, when the mean number of errors of the LSD-treated group was $4·0 \pm 0·9$ s.e.—quite similar to that of 3·5–0·7 s.e. for the control group. A subsequent test 5 weeks after discontinuing LSD injections indicated that the mean of the errors in the LSD-treated mice was still $4·0 \pm 1·1$ s.e. while that in the saline control group had decreased to $2·2 \pm 0·9$ s.e. This difference between the two groups is not statistically significant ($P = 0·2$–$0·3$).

The data obtained in the present experiment are consistent with the previous report[1] of an acute impairment of learning in mice as a result of administration of LSD. But the ability of the LSD-treated mice to learn an avoidance task had returned to the level of the control mice by 3 weeks after the chronic administration of LSD. We therefore conclude that there is no evidence of significant long-term impairment of learning attributable to LSD.

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## Inhibitory Action of the Amygdala on the Lateral Hypothalamic Area in Rats

THE mammalian lateral hypothalamic area (LH) and the ventromedial hypothalamic nucleus (VMH) are involved in feeding and satiety function, respectively[1]. There is also reciprocity of electrical activity between the two[2]. Anatomically related to these areas, the amygdala has been shown to be involved in the same functions. Lesions of the basolateral nucleus of the amygdala results in hyperphagia[3], while its electrical stimulation arrests feeding behaviour[4]. The stimulation of the amygdala also produces changes in the spontaneous discharge pattern of LH units, suggesting an inhibition or an activation–inhibition sequence between the LH and the amygdala[5,6]. We report here evidence that the inhibitory effect of the amygdala on the LH neurone is due to a long lasting inhibitory postsynaptic potential (IPSP) exerted through the stria terminalis.

While rats were under light ether anaesthesia[6], intra and extracellular potential recordings were made from neurones in the centre of the LH[6] by means of glass microelectrodes filled with 3 moles of KCl (d.c. resistance, 20–80 MΩ). While intracellular recordings were being made, polarizing currents were applied across the cell membrane through the recording electrode by means of a modified constant current device[7]. Bipolar stimulating electrodes (40–80 kΩ) were always placed in the amygdala[6] and in the stria terminalis (A, 4·38; L, 3·50; H, +7·70, after König and Klippel[8]). Stimulating pulses lasted 0·1 ms and were less than 0·2 mA in intensity.

Single pulse stimulation to the amygdala produced a characteristic evoked potential in the LH consisting of an initial negative deflexion followed by a positive deflexion (N and P waves respectively, upper left of Fig. 1*A*). Mean latency and peak time of the N wave were about 6 and 12 ms respectively. The P wave lasted about 30 ms, and the N wave always appeared at a lower threshold than the P wave. Furthermore, the depth profile of the N and P waves within the LH differed in distribution—P waves were recorded almost equally throughout the dorso-ventral extent but N waves mostly in the ventral half. Thus each wave seems to be mediated by a separate pathway.

The evoked potentials produced by paired stimuli to the amygdala (Fig. 1*A*) showed the inhibitory nature of the P wave on the N wave. As the interstimulus interval was decreased, the amplitude of the N wave to the second stimulus became progressively suppressed, as