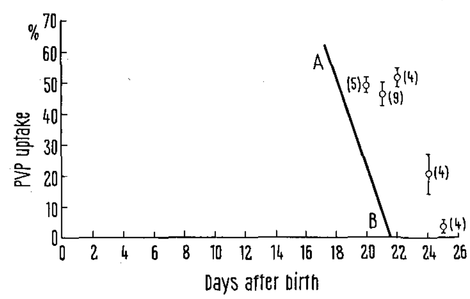
which duodenal alkaline phosphatase activity increases; furthermore, large doses of the steroids deoxycorticosterone acetate or cortisone acetate, both of which produce a rise in duodenal alkaline phosphatase activity, also induce premature closure[4]. In view of the previous observation that cortisone induced a fall in serum γ-globulin of newborn rats[5], it seemed probable that the adrenal cortex might be implicated in closure.

Suckling rats were bilaterally adrenalectomized under ether anaesthesia at 3, 14, 16, 18 or 23 days of age. Mortality rate was high, particularly in 3-day-old rats; thus most of the 65 animals adrenalectomized at day 3 died 1–7 days after the operation and only 5 survived to day 21. These observations are consistent with those of GILLMAN and GOLDBERG[6]. After adrenalectomy, the infant rats were returned to the mother until the day when they were fed (^{125}I) polyvinyl pyrrolidone (PVP) of mean molecular weight 160,000 as previously described[2].

The Figure represents the uptake of PVP by the entire small intestine plotted against age in control (sham operated) and experimental rats, adrenalectomized on day 18. Adrenalectomy was found to delay closure. Thus, at 21 days, the control animals showed virtually no uptake (mean: 7%), whereas the mean uptake of the adrenalectomized animals was 48%. From the Figure it can be seen that it is possible to delay the phenomenon of closure by up to 4 days by removal of both adrenal glands at day 18. Rats adrenalectomized earlier than 18 days exhibited a similar delay in closure, however, rats adrenalectomized on day 23 and tested on days 24 and 26 showed no uptake of PVP, presumably because closure had taken place before the operation.

CLARKE and HARDY[7] showed that there was a rapid change in the permeability characteristics of the cells appearing on the villi of the distal small intestine in the young rat on or about the 18th day of life. They attributed the overall decline in PVP uptake to the progressive replacement of the immature villous epithelial cell population by more mature cells which are unable to take up macromolecules.

The present results show that the time at which the 'new' cells (impermeable to macromolecules) first appear is retarded by adrenalectomy. However, the fact that closure was not permanently delayed suggests that some other factor, which normally acts in conjunction with the adrenal steroids, is implicated in the control of this phenomenon[8].



Effect of adrenalectomy on the uptake of PVP by the small intestine of the young rat. A–B regression line calculated by the method of least squares for sham-adrenalectomized animals aged 18–22 days old inclusive. ○, mean and S.E.M. for groups of animals adrenalectomized at 18 days (Figures in parentheses indicate number of animals).

Résumé. L'absorption de ^{125}I polyvinyl pyrrolidone K. 60 par l'intestin grêle a été mesurée dans des rats dont les capsules surrénales avaient été enlevées à 3, 14, 16, 18 et 23 jours après la mise bas. Des animaux témoins ont été opérés sans ablation des capsules surrénales et ils n'ont plus absorbé le PVP 20 à 21 jours après la mise bas, mais lorsque les capsules surrénales furent enlevées avant 23 jours après la mise bas, le PVP a été absorbé environs 4 jours au-delà des délais témoins.

V. G. DANIELS and R. N. HARDY

Physiological Laboratory, Cambridge, CB2 3EG (England), 3 September 1971.

1 R. HALLIDAY, Proc. R. Soc. B., *143*, 408 (1955).
2 R. M. CLARKE and R. N. HARDY, J. Physiol., Lond. *204*, 113 (1969).
3 F. W. R. BRAMBELL, *The transmission of Passive Immunity from Mother to Young* (North-Holland, Amsterdam 1970).
4 R. HALLIDAY, J. Endocrin. *18*, 56 (1959).
5 B. N. HALPERN, P. LIACOPOULOS, R. TOURNEUR and B. DREYFUS, C.r. Soc. Biol., Paris. *151*, 436 (1957).
6 J. GILLMAN and L. GOLDBERG, Endocrinology *31*, 201 (1942).
7 R. M. CLARKE and R. N. HARDY, J. Physiol., Lond. *204*, 127 (1969).
8 Acknowledgments. We would like to thank the Agricultural Research Council for financial support and Mr D. CLARK for his care of the experimental animals.

'Handedness' in Mice: Some Behavioural Correlates

In 1929 TSAI[1] demonstrated for the first time that animals, like humans, also exhibit a definite preference for the use of one of their forelimbs. Since then, paw-preference has been demonstrated in cats (PETERSON and CHAPLIN[2], monkeys (BROOKSIDE and WARREN[3]) and mice (COLLINS[4]).

Methods. 47 adult (8-week-old) male mice of the inbred strain C57BL/6J were used. Food deprived mice were placed in a paw-preference apparatus (Figure 1). A right paw-preference score was taken by observing the number of times the animal reached for food inside a narrow tube with its right front paw in a total of 50 reaches.

The apparatus used for teaching the animals a brightness discrimination was a Y-maze. The floor of the maze was translucent with facilities for illuminating either of the two alleys.

Radio-frequency lesions were placed in the 5th layer of the motor cortex of some of the animals at the stereotaxic coordinates 1.3 mm anterior to bregma, 1.8 mm lateral. These values were extrapolated, on the basis of a pilot histological study, from those given by ROOK[5] for the rat.

1 L. S. TSAI and S. MAURER, Science, *72*, 436 (1930).
2 G. M. PETERSON and J. P. CHAPLIN, J. comp. Psychol. *33*, 343 (1942).
3 K. H. BROOKSIDE and J. W. WARREN, Anim. Behav. *10*, 222 (1962).
4 R. L. COLLINS, J. Hered. *59*, (1968).

Results and discussion. Paw-preference scores were taken on 2 consecutive days; the mean of these 2 scores was used as the paw-preference score. Animals were very consistent in their paw-preference, the correlation between the 2 scores being + 0.99. The frequency distribution of paw-preference scores is shown in Figure 2.

Animals with more than 38 reaches with 1 paw were classified as right or left 'handed' accordingly; animals with less than 30 reaches with 1 paw were classified as ambidextrous. Animals with more than 30 but less than 38 reaches with 1 paw were discarded in order to increase the rigour of the classification.

Learning scores were obtained by training the animals in a brightness discrimination situation. Analysis of variance showed no significant difference between learning scores of right 'handed' and left 'handed' animals ($p > 0.75$). Furthermore, the learning scores of all animals were ranked according to order of magnitude; animals with learning scores below the median were classified as poor learners. The possibility that among poor learners animals with a left paw-preference might occupy the lower extreme of the range was tested by the Mann-Whitney U-test. U was not significant at the 0.05 level.

The hypothesis that paw-preference may be related to turning preference was tested. Animals were quite consistent in choosing one side of a Y-maze, in the absence of any differential cues or re-inforcement, over a period of 5 days (analysis of variance, $p < 0.0001$). This turning preference was not related to paw-preference (analysis of variance, $p < 0.25$).

It was attempted to induce changes in paw-preference by placing a localized radio-frequency lesion in the 5th layer of the motor cortex. Lesions were either ipsilateral or contralateral with reference to paw preferred. Animals with lesions on the contralateral side were expected to show a change in paw-preference in the opposite direction from their pre-operative paw-preference; animals with lesions on the ipsilateral side were expected to show a change in the same direction as their pre-operative paw-preference (i.e. become more extreme). Analysis of variance did not show any systematic effect of the lesions, although changes in paw-preference in the predicted direction were induced in several animals.

The possibility was considered that animals with a less extreme paw-preference are neuroanatomically more plastic, than animals with extreme paw-preference, thus possessing greater potentialities for a change in paw-preference following a cortical lesion. Animals were divided in 2 groups (extreme vs. non-extreme) on the basis of their preoperative paw-preference score. A Chi-square test on the paw-preference changes of these 2 groups, following the placement of cortical lesions, showed a probability of $0.05 < p < 0.10$, thus approaching significance.

What are the factors that influence 'handedness' in mice? The advantage of studying 'handedness' in animals lies in the absence of a cultural bias favouring the use of the right forelimb. COLLINS[4] has shown that this lateral assymmetry is not under direct genetic control. The environmental situation would seem to be important and to clarify its contribution, a developmental study is currently under progress in this laboratory. Finally, it is possible that if one studied more complex types of mouse behaviour than the ones presented in this study, one might find that specialization with regard to 'handedness' improved the animals' performance.

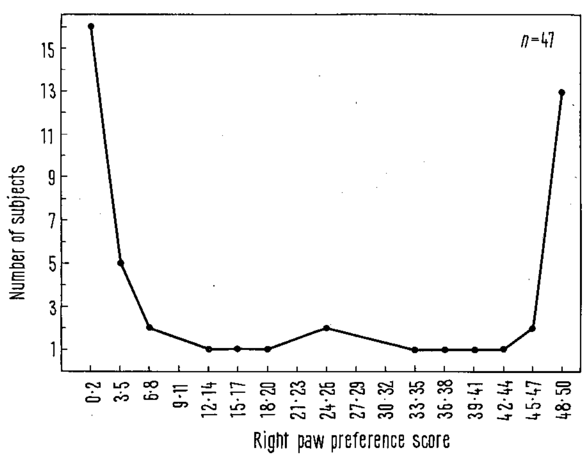


Fig. 1. Frequency distribution of paw-preference scores.

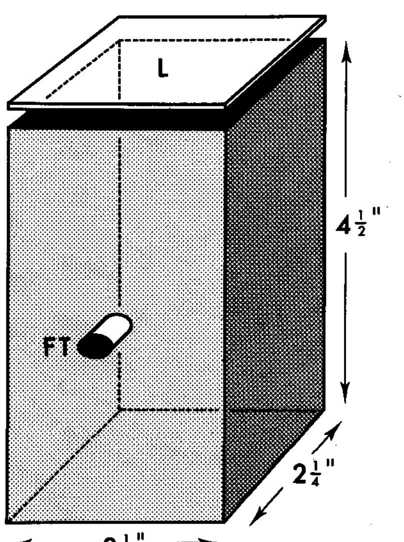


Fig. 2. Paw-preference apparatus used in this study; front view. FT, feeding tube; L, lid.

Résumé. Nous avons observé que les souris manifestent une préférence pour l'usage de l'une ou de l'autre de leurs pattes antérieures. Cette préférence ne dépend ni de la capacité d'apprendre ni de la tendence à prendre l'une ou l'autre pour tourner. On peut modifier cette préférence par des lésions corticales.

J. PAPAIOANNOU

University of Cambridge, Department of Anatomy, Downing Street, Cambridge CB2 3DY (England), 11 August 1971.

[5] L. W. ROOK, Doctoral thesis, University of New Mexico (1961).

[6] Acknowledgments. I thank Dr. R. L. COLLINS for his help. This work was conducted in the Jackson Laboratory, Bar Harbour (Maine, USA) and financed by N.S.F. grant No. GY-826.