THE LEVEL OF PERFORMANCE IN THE WHITE RAT[1]

SEVERAL investigators[2] have reported that glutamic acid increases the mental and physical alertness of epileptic patients. This clinical finding led Zimmerman and Ross[3] to test the effect of this substance on maze learning in the white rat. These workers added 200 mg of glutamic acid to the diet of normal white rats for a period of two weeks and continued this during the period of training. They found that the glutamic acid group learned a simple maze much faster than the control group. In fact, the total number of trials required to learn was less than half that taken by the controls.

The above result suggested the possibility that adding l(+)glutamic acid to the normal diet might also enable white rats to learn more complex problems than rats fed only a normal diet. The interest here would be not so much in speed of learning as in the general level of performance finally reached on a task of increasing difficulty. A problem box suitable for such a test of intelligence level was recently devised[4] and has been used extensively in this laboratory in comparing various mammalian forms.

The apparatus consists of a circular cage with a series of floor plates to be stepped upon by the animal, in a given sequence, in order to secure food. The animal passes gradually from a simple level (single plate) to increasingly more difficult ones (two to ten or more plates). When the pattern becomes too difficult the animal fails and the last step learned is taken as the level score of the individual. Averages representing the level of various groups can readily be computed. This problem box was used in the present study.

A total of seventeen rats thirty days of age, and of the same strain, were divided into two groups as follows: (1) control group, eight rats and (2) glutamic acid group, nine rats. A well-balanced diet was employed and the daily allowance of food per animal was the same for both groups. The rate of gain in weight throughout the experiment was the same for both groups. The daily dosage of glutamic acid for each animal in the experimental group was as follows: 150 mg for the first fourteen weeks, including two weeks before training began; 250 mg for the next twenty-six weeks covering the balance of the training period. The feeding procedure was the same as that described by Zimmerman and Ross[3] in their maze study.

The results in terms of level-score are shown in Table 1.

TABLE 1

Setting	Glutamic acid group		Control group	
	Total number	Number successful	Total number	Number successful
1-Plate	9	9	8	8
2-Plate	9	9	8	4
3-Plate	9	8	8	2
4-Plate	9	1	8	0
5-Plate	9	1	8	0
6-Plate	9	0	8	0

As will be seen, the glutamic acid group made a much better showing than the control group in several respects. All rats of the former group succeeded on the 2-plate level, whereas 50 per cent. of the control group failed on this level. Furthermore, all but one of the glutamic acid group passed the 3-plate problem as compared with only 25 per cent. of the control group. Of still greater importance is the fact that none of the control group went beyond the 3-plate step, whereas one rat of the glutamic acid group was able to master both the 4-plate and the 5-plate settings. This fact is especially significant, since these last two settings are much more complex and difficult than the earlier ones. For example, at the 4-plate sequence the animal is required to reverse his direction of locomotion as well as to add another plate to the 3-plate series.

It thus appears that the l(+)glutamic acid group is superior in general level of performance in terms of several criteria. It will be admitted that the present groups are rather small to serve as a basis for a definite conclusion. However, the level of the control group indicated above is in general agreement with that of Riess.[5] He tested thirty-three rats on the same apparatus in this laboratory and found that none of them was able to go beyond the 3-plate sequence.

Our results would seem to indicate that the administration of additional l(+)glutamic acid does cause white rats to advance further in a series of increasingly difficult problems. This applies to the group as a whole through the 3-plate sequence, and is especially marked in the case of the one animal which went far beyond this level. Results might well be much more clear-cut with a larger glutamic acid group. No attempt was made to determine the physiological influence of l(+)glutamic acid in thus raising the level of problem solving.

A more detailed report of this study will be published elsewhere.

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[2] H. Waelsch and J. C. Price, *Archives of Neurology and Psychiatry*, 51: 393–396, 1944.

[3] F. T. Zimmerman and S. Ross, *Archives of Neurology and Psychiatry*, 51: 446–451, 1944.

[4] C. J. Warden, T. N. Jenkins and L. H. Warner, *Comparative Psychology*, 1: 350–354, 1935.

[5] B. F. Riess, *Genetic Psychology Monograph*, 15: 309–368, 1934.