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The relation between spontaneous activity and the ability to learn a simple maze.

By HOWARD S. LIDDELL (by invitation).

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In order to determine the effect of thyroidectomy on the neuro-muscular mechanism of sheep, methods were devised for the estimation of spontaneous activity and intelligence.[1] Activity was measured by a pedometer and intelligence was estimated by causing the animals to learn to escape from a labyrinth with a single cul de sac, the position of which could be reversed by a system of gates. In the type of problem represented by the labyrinth in which the solution depends upon vigorous random movements rather than visual discrimination one would be led to expect some definite relation to exist between the spontaneous activity of an animal and its proficiency in learning to escape from the maze. If one found that those sheep which were most active also made the best record in learning the labyrinth, it would be necessary to conclude that proficiency in learning the maze was an indirect way of estimating the animal's spontaneous activity and not primarily a measure of intelligence. The attempt was, therefore, made to determine for sheep the relation between activity and learning.

The experiments consisted in recording the spontaneous activity of a number of sheep in the flock and in comparing the total number of steps taken during a certain period with the records of the number of errors, steps, seconds, and trials obtained from causing the animals to learn the simple labyrinth and the labyrinth with the position of its cul de sac reversed. One hundred and fifty-two such comparisons were made between sheep which had learned the simple maze and one hundred comparisons between those which, after having learned the simple maze, had learned it again with the position of its cul de sac reversed. Activity was measured for periods ranging from four to thirty-seven days. An inspection of these results failed

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[1] Liddell, H. S., *Quart. J. Exp. Physiol.*, 1923, xiii, 191.

to discover any constant or close relation between learning and activity. It must be concluded, therefore, that even so simple a problem as the learning of this maze is a test, however crude, of intelligence rather than an indirect means of estimating activity. The expenses of this investigation were in part defrayed by a grant from the Sage Research Foundation.

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The possible influence of fatigue on the reaction time of thyroidectomized sheep.

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The time required by a sheep to escape from a simple maze which it has previously learned has been taken as a measure of its reaction to environmental change. It was found that a thyroidectomized sheep exhibits a greater reaction time than does its normal twin when it runs a simple maze in which the position of the cul de sac is reversed at every trial and four successive trials per day are given.[1] These preliminary results were obtained with a maze sixty feet in length. The greater time required by the cretin sheep was largely due to frequent pauses but also to its sluggish progression through the maze. It was suspected that muscular fatigue might be a factor of importance in accounting for the difference in reaction time between the normal and cretin sheep. In order to eliminate this possibility by reducing locomotion to a minimum a system of three gates was constructed whereby the same maze could be shortened until the distance from the starting box to feeding compartment was reduced to six feet.

The twin sheep, above referred to, were caused to learn the same alternation problem in this short maze that they had previously learned in the long maze. In this case, also, the cretin required a greater time than its normal twin to escape from the labyrinth. The difference between the normal and thyroid-

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[1] Liddell, H. S., Proc. XI Int. Physiol. Congress, Edinburgh, July, 1923.