different times during the 24-hour period, we recorded the exact weight of the food given during the 24 hours and in the experiment. Moreover, in order to equalize food excitability, 60-80 g of food was given 1-2 hours before the experiment. The type of illumination was also taken into account; the animals were put in a light-proof chamber with artificial illumination 1-2 days before the experiment or on the day of the tests. No experiment was done more often than once a week. The background of conditioned reflex activity was always examined during the interval between the experiments.

EXPERIMENTAL RESULTS

The main point of interest was the difference between the morning and evening nervous activity of the chickens. Our basic test was to check the retention of the stereotype in the morning and in the evening (8-10 o'clock p.m.). One could expect that the magnitude of the positive conditioned reflexes would decrease in the evening hours due to the gradual exhaustion of the brain nerve cells of the chickens during the day.

The experiments conducted showed that a definite decrease in the magnitude of the positive conditioned reflexes actually did occur in the chickens at evening time. The magnitude of the positive conditioned reflexes was determined according to the length of the conditioned reflex latent period and was expressed in percent. The differentiation was determined in a similar fashion. The results of this study are given in Table 1.

TABLE 1

Change in the Magnitude of Positive Conditioned Reflexes in Chickens During the Morning and Evening Hours

Magnitude of positive conditioned reflexes, in %			
Morning (8-10 o'clock a.m.)	Number of tests	Evening (8-10 o'clock p.m.)	Number of tests
74.6 ± 1.8	73	50.7 ± 3.2	18

The differences discovered in the magnitude of the positive conditioned reflexes at different times of day are statistically true.

With the disappearance or reduced magnitude of the positive conditioned reflexes in the evening, a general inhibition and a state of hypnosis developed in the chickens during the experiment.

Having observed the reduction in the general magnitude of the positive conditioned reflexes which occurred during the evening, we found it interesting to trace the dynamics of conditioned reflex activity during the course of 24 hours. Therefore, the state of the conditioned reflex activity in the chickens was determined every 4 hours. To increase the strain on the animals' brains in order to determined their efficiency, the number of stimuli in the control testing was increased to 20. In order to show the 24-hour pattern of conditioned reflex activity, the chamber was illuminated around the clock.

From the experiments conducted in such conditions, we observed regular changes in the conditioned reflex activity of the chickens during the 24-hour period. The magnitude of the positive conditioned reflexes decreased towards evening, with the greatest reduction observed from about midnight to 4:00 a.m., and then increased again towards morning (Fig. 1). The differentiation remained about the same throughout the 24-hour period, becoming only slightly inhibited at 5:00 p.m. which was probably connected with a reduced concentration of internal inhibition. The results of this series of experiments agree with those obtained from research on the 24-hour pattern of conditioned reflex activity in monkeys [2, 7].

The motor activity in the chickens during the 24-hour period was recorded at the same time as the conditioned reflex activity. Here, we noticed that the changes in motor activity did not coincide with the changes in the magnitude of the positive conditioned reflexes in the course of the 24-hour period. Although motor activity in the chickens stopped at 6-7 o'clock p. m. with conditions of round-the-clock illumination (Fig. 2), the

maximal decrease in the magnitude of the conditioned reflexes was not observed until 1 o'clock a. m. During the experiments conducted in the evening, motor activity was observed to be restored in some chickens (see Fig. 2). The effect of the conditioned stimulus was so strong that the chickens, which had been asleep before its use, responded with a positive conditioned reaction. The question arose – what relations existed between the inhibition in the motor analysor and the state of stimulation which occurred with the action of the conditioned stimulus?. The greatest reduction of conditioned reflex activity, resulting in separate cases in the complete disappearance of the conditioned reflexes, occurred from midnight to 4:00 a.m. One must note that the greatest reduction of several physiological functions in animals possessing the day-time type of activity occurred during this time of the 24-hour period.

We know from I. P. Pavlov's theory that sleep is inhibition irradiated throughout the cerebral cortex. The phenomenon of successive inhibition occurs when internal inhibition is irradiated through the cerebral hemispheres. Similar relations were observed in our experiments.

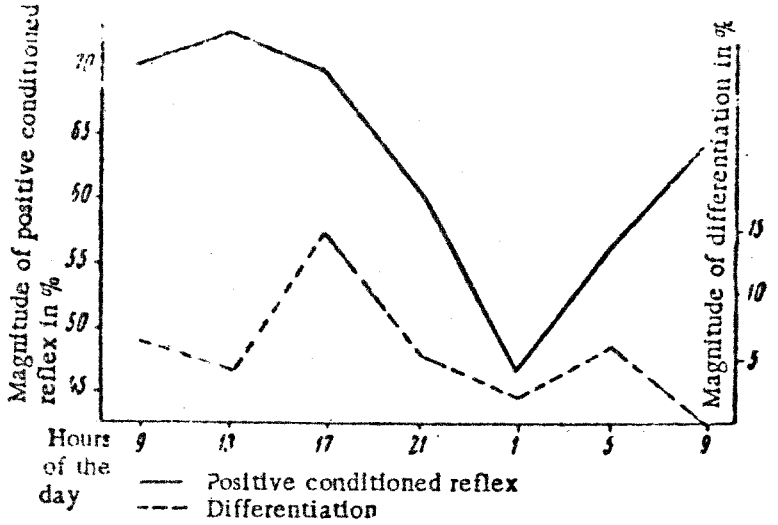

Fig. 1. Change in the magnitude of positive and negative conditioned reflexes in chickens during the course of a 24-hour period.

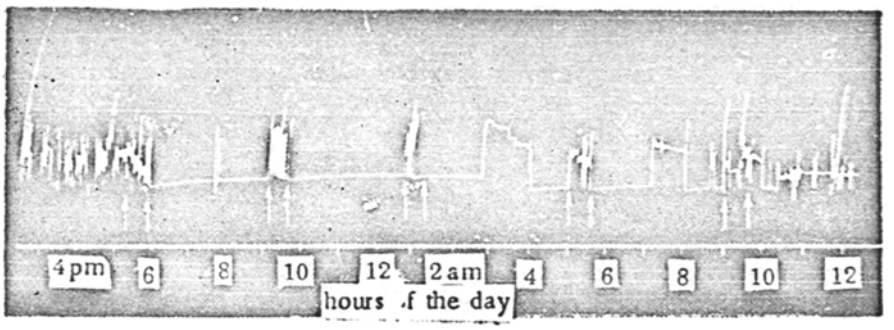

Fig. 2. Recorded motor activity of a chicken during a 24-hour period in conditions of round-the-clock illumination. The arrows show the times at which the experiments were conducted.

The phenomenon of successive inhibition was often recorded in the evening experiments; this phenomenon occurred after the use of differentiation stimuli and was expressed by either a considerable prolongation of the reflex latent period or by the complete disappearance of the reflexes. Usually this occurred at the end of the experiment.

In order to specifically trace the development of successive inhibition, we changed the stereotype so that all the differentiation stimuli were used first and then all the positive stimuli were used. This method of conducting the morning and evening experiments showed that the greatest development of successive inhibition was in the evening; part of the chickens lost some of the reflexes completely and others went to sleep. The results of the experiment are shown in Table 2.

TABLE 2

Magnitude of Positive Conditioned Reflexes After the Use of 4 Differentiation Stimuli at the Beginning of the Stereotype

Number of chickens in experiments	Magnitude of positive conditioned reflexes, %	
	Morning (8-10 o'clock a.m.)	Evening (8-10 o'clock p. m.)
8	66.50	42.00

From the results of this experiment, one can affirm that the greatest irradiation of internal inhibition occurs in the evening, and therefore the development of successive inhibition.

We also studied the features of extinguishing inhibition in order to ascertain the properties of higher nervous activity in the chickens during the evening. The process of extinguishing the positive conditioned reflex was rather complex; it could characterize the force and mobility as well as the steadiness of the nervous processes. Nevertheless, it was interesting to examine the development rate of extinguishing inhibition during the morning and evening hours.

The reflex was extinguished at 30 second intervals until 5 and 10 negative reactions to the positive stimulus were obtained. The experiments showed that the development rate of extinguishing inhibition was slower in the evening, especially when the extinguishing process was continued until 10 negative reactions were obtained. Similar data were obtained in experiments on monkeys [7].

The results of the experiments permit us to make the following conclusions.

The properties of higher nervous activity in chickens change regularly in the course of a 24-hour period. The efficiency of the brain nerve cells declines in the evening. In conditions of round-the-clock illumination, we observed 24-hour pattern of conditioned reflex activity, expressed by a reduction in the magnitude of the positive conditioned reflexes during the evening and night and by an increase of these indices in the morning hours. The greatest reduction in the magnitude of conditioned reflex activity occurs from midnight to 4:00 a.m.

There is a greater development of successive inhibition in chickens during the evening than in the morning.

Extinguishing inhibition develops more slowly in the evening than in the morning.

The conditioned reflex method of research is one of the most important ways of studying 24-hour periodicity in animals.

SUMMARY

The 24-hour rhythm of the conditioned reflex activity was studied in Leghorns. The value of conditioned reflexes was determined every 4 hours to the positive and negative (alternating during the experiment) color monochromatic stimulants. The motor food method was used. The deepness of the successive inhibition and the rapidity of formation of extinguishing inhibition during the morning and evening hours was determined in other series of experiments. The presence of 24-hour rhythm of conditioned reflex activity of chickens was established. The most pronounced decrease in the conditioned reflex activity of chickens occurs from midnight to 4 o'clock in the morning. The successive inhibition is enhanced in the evening, while the development of the extinguishing inhibition is delayed.

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