TYPE OF HIGHER NERVOUS ACTIVITY CLASSIFIED ACCORDING TO FOOD AND ACID-DEFENSE CONDITIONED REFLEXES

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The question concerning the comparative typological characteristics of higher nervous activity according to the results obtained from studying the dynamics of conditioned reflexes based on different unconditioned stimuli has interested certain authors for a long time. A. G. Ivanov-Smolenskii [2] and his co-workers [3, 6] established that the typological properties can vary as to character in the same child, depending on the type of reinforcement used. For example, the use of defense reflexes could classify the child as the passive type, while according to food reflexes, the same child could be found to be the active type.

A. P. Chestnokova [7], M. S. Alekseeva [1] and A. M. Klochkov [4], who compared the typological properties of dogs according to food and acid-defense conditioned reflexes, found that the differentiation of conditioned stimuli and the alteration of their signal meaning occurred more slowly and with great fluctuations in one animal than when food reinforcement was used with the same animal. The fact that unitypical conditioned reflex processes can occur differently with different unconditioned reinforcements, i. e. do not coincide as to quantitative parameter, is somehow not very surprising. Our purpose was to demonstrate the character of these differences in order to facilitate the determination of an animal's typological properties.

This article presents the results obtained from experiments determining the type of higher nervous activity possessed to two dogs (Belyi and Chernyi), using two methods simultaneously, i. e. the food-secretomotor and acid-defense methods.

EXPERIMENTAL METHODS

The experiments were performed twice a day, by the food method in the morning and by the acid-defense method in the evening. This experimental plan enabled us to keep the experimental results from being affected by possible changes in the general condition of the animals, as would have occurred had type determination been done first by one method and then by the other (as was done by the authors cited above).

In our experiments, the food conditioned stimuli differed from the acid-defense, but the differentiations were selected so that the differentiation conditions would be approximately equal in both cases. Type determination followed a program similar to the abbreviated standard of M. S. Kolesnikov and V. A. Troshikhin [5].

Food Method. Positive food-secretomotor conditioned reflexes developed in Belyi and Chernyi at the 14th and 15th combinations, respectively. The dependence of the effect on the strength of the conditioned stimulus was well expressed.

A differentiating inhibition was formed especially quickly in Belyi. The motor reaction (running up) to the food dish was inhibited by the 12th use of the negative stimulus, and the secretory component, by the 18th use. After this, the differentiation was, as a rule, absolute (Fig. 1, a). The differentiation was slower to develop in Chernyi, and then only relatively absolute (Fig. 1, a). The amount of conditioned secretion to the inhibitory

TABLE 1

Change Effected by Caffeine in Secretory Conditioned Reflexes of Dogs

Experimental dogs	Experiment the evening before the use of caffeine	Caffeine, in a dose of 0.3 g	Experiment the evening before the use of caffeine	Caffeine, in a dose of 0.6 g
Belyi	145 / 0	153 / 0	156 / 0	189 / 0
Chernyi	171 / 26%	176 / 30%	166 / 34%	208 / 76%

Note: The figure above the line is the sum of the positive conditioned reflexes in scale divisions; the figure below the line is the differentiation in percent of the positive reflex.

stimulus was, on the average, 20-30% of the amount of secretion to the positive stimulus. In most cases, the motor reaction was inhibited, or was expressed by uncompleted running approaches (with the animal returning to its original place before reaching the food dish).

We used caffeine in doses of 0.3 and 0.6 g in order to test the force of the stimulating and inhibitory processes.

EXPERIMENTAL RESULTS

The first dose (0.3 g) of caffeine did not noticeably affect the animals' conditioned reflex activity. The 0.6 g dose of caffeine considerably enhanced the positive secretory conditioned reflexes in both animals. The caffeine caused a considerable disinhibition of the differentiation in Chernyi, but did not affect the differentiation in Belyi (Table 1). No disturbances in conditioned reflex activity were observed in the experiments performed subsequently.

The strength of the inhibitory process was tested by prolonging the action of the differentiation stimulus to 3 minutes; this did not cause any significant disinhibition of the differentiation in Belyi. In this dog, the dynamics of salivation were, in scale divisions (every 30 seconds), as follows: 5-3-3-3-0-0. In Chernyi, this experiment caused extensive disinhibition of both the secretory and motor components of the food reflex. Salivation every 30 seconds was 16 – 15 – 9 – 9 – 12 – 0 scale divisions. After these experiments, conditioned reflex

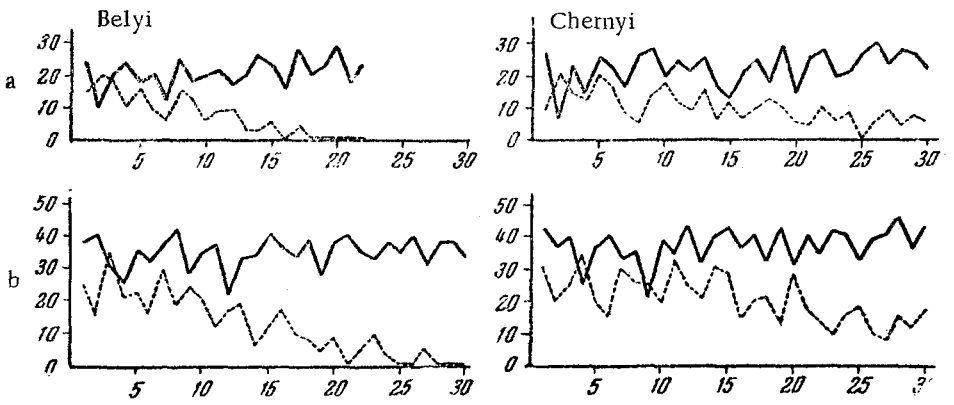

Fig. 1. Development of differentiating inhibition.
a) With use of food method; b) with use of acid-defense method.
Symbols: The ordinate axis represents the conditioned secretion in scale divisions; the abscissa axis represents the ordinal number of the use of the conditioned stimuli. Solid line – positive reflex; dotted line – inhibitory reflex.

TABLE 2

Change Effected by Caffeine in Defense Conditioned Reflexes of Dogs

Experimental dogs	Experiment the evening before the use of caffeine	Caffeine, in a dose of 0.3 g	Experiment the evening before the use of caffeine	Caffeine, in a dose of 0.6 g
Belyi	201 0	211 0	205 0	234 0
Chernyi	229 36%	240 50%	233 43%	257 91%

Note: Figures mean the same as in Table 1.

activity again proceeded normally.

The lability of the nervous processes was determined by altering the signal meaning of the conditioned stimuli. Belyi found this easy to cope with, which showed that the lability of the nervous processes was good (Fig. 2, a). Chernyi took longer to comprehend the alteration; he comprehended the alteration of the inhibitory stimulus' meaning more quickly than that of the positive (Fig. 2, a).

On the basis of the experiments performed, Belyi could be described as an animal of the strong, balanced and mobile type. Chernyi could also be classified as the strong type, but with nervous processes which were excitable and of average lability. A considerable predominance of the stimulation process over the inhibitory was characteristic of this animal, as was clearly shown by all the indices of conditioned reflex activity.

Acid-Defense Method. Positive conditioned reflexes were developed in Belyi and Chernyi by the 12th and 10th combinations respectively. The dependence of the conditioned reflex effect on the strength of the stimulus was as well expressed as with the food reinforcement. The acid-defense conditioned reflexes exceeded the food reflexes in value by an average of 25% in Belyi, and by an average of 35% in Chernyi.

Differentiating inhibition was slower to develop and less profound under conditions of acid reinforcement than with the food reinforcement. As with the food method, the differentiation was absolute with the defense reflexes in Belyi, but was slower to develop and somewhat less stable (Fig. 1, b). In Chernyi, the differentiation was relative in both cases, but even more so with the acid reinforcement; the differentiation reflex was 35-40% of the conditioned reflex (Fig. 1, b).

In a dose of 0.3 g, caffeine slightly enhanced the conditioned reflexes in the experimental animals; only in Chernyi was the differentiation slightly disinhibited.

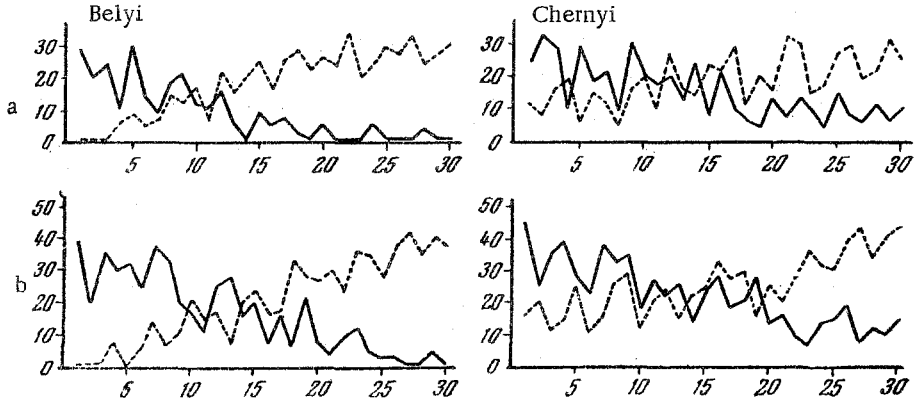

Fig. 2. Alteration of signal meanings of the conditioned stimuli.
a) With food method; b) with acid-defense method; dotted line – positive reflex; solid line – inhibitory. Symbols are the same as in Figure 1.

In a dose of 0.6 g, caffeine further enhanced the positive conditioned reflexes. The differentiation was slightly disinhibited in Belyi (Table 2). There was a strong disinhibition of the differentiation and an increase in general motor activity in Chernyi.

The experiments did not affect in any way the conditioned reflex activity of the animals in subsequent experiments.

In the experiment prolonging the action of the differentiation stimulus to 3 minutes, a strong and stable inhibition process was observed in Belyi, as in the analogous experiment made under conditions of the food method.

Salivation every 30 seconds in Belyi was 7-3-8-0-3-4-0, in scale divisions. In Chernyi, this experiment had about the same results as that with the food reinforcement, i. e. strong disinhibition of the differentiation was observed. The course of salivation every 30 seconds in scale divisions was as follows: 25 – 30 – 16 – 8 – 0 – 20 – 5. On the day after this experiment, the differentiation was observed to have somewhat deteriorated in Chernyi.

Alteration of the signal meanings of the conditioned stimuli was comprehended by both dogs somewhat more slowly in the experiments with the acid reinforcement than in those with the food reinforcement. However, in this case also, Belyi manifested very labile nervous processes and became completely adjusted to the change (Fig. 2, b). The lability of the nervous processes was found to be low in Chernyi (Fig. 2, b), as in the experiments with food reinforcement.

A comparison of the experimental data obtained under the two kinds of experimental conditions showed that in both cases, both dogs were shown to belong to the strong type of nervous activity. The main differences between the two dogs in respect to balance and lability of the nervous processes were equally apparent under both sets of conditions. We estimate the typological properties of an animal, of course, according to the pertinent quantitative indices of its conditioned reflex activity, which indices are established during the accomplishment of experimental tasks. However, as we have seen, the quantitative indices characterizing the resolution of the same experimental problem can vary in the same animal according to the type of unconditioned reinforcement used. By no means does it follow from this that it is a question of varying typological properties in the same animal.

A single type can certainly manifest these differences under different conditions which evidently require different exertion of the cortical nervous functions.

Thus, for example, an animal can possess an inhibitory process strong enough for the development of a stable differentiating inhibition under conditions of the food method, yet not strong enough to form as stable a differentiation under conditions of the acid-defense method. The same can be said of the lability of the nervous processes. The question concerning the possible reasons for such interrelations requires special discussion.

Therefore, the results of the experiments conducted show that experimental data regarding type of higher nervous activity and obtained by both the food and acid-defense methods reflect the typological features of the same animal synonomously.

SUMMARY

A parallel determination of the type of the highest nervous activity was carried out in two dogs by two different methods (by food secretory motor and by acid-defense). According to the data of the food method, one dog appeared to be of a strong, well balanced and labile type, while the other was a strong, excitable type with an average lability of the nerve processes. Analogous typological characteristics of these animals were also established by the acid-defensive method.

Thus, the results of these experiments demonstrated that data obtained by the food and acid-defense methods, reflect the typological characteristics of animals in the same way.

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