

FORMATION OF A ONE-SIDED FOCUS IN THE CORTICAL REPRESENTATION OF AN UNCONDITIONED REFLEX UPON PROLONGED STIMULATION

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It has been established by the work of a number of authors [1, 2, 4], that with undifferentiated stimulation combined with unconditioned stimulation of a tongue area of one side, a conditioned reflex is developed only for the salivary gland of the corresponding side. It has been shown [3], that the one-sided food-conditioned reflexes are slightly different from the ordinary food-conditioned reflexes (they are smaller and increase when repeated during the given day of experiment). Apart from this, it was observed that if for example "left-sided" stimulators are used for a long time and then a change is made to the "right-sided", for a while the reaction still takes place on the left. This suggested the idea that during a lengthy application of one-sided conditioned and unconditioned stimulators, a focus of latent stimulation is formed in the centers of the corresponding side.

In the present paper we have attempted to prove this assumption.

EXPERIMENTAL

The experiments were carried out on two dogs in which areas of the tongue and the ducts of the parotid salivary glands were brought to the surface on both sides by Abuladze's method. The conditioned and unconditioned reactions were registered by the salivary secretion from both parotid glands on the Ganike-Kupalov scale.

In the dog Belenkaya a conditioned reflex was worked out for a bell, strengthened by 20 g of dampened dried meat powder. The bell was sounded for 20 seconds and the intervals between stimulations were 5 minutes. A conditioned reflex was established on the 23rd combination of the bell with the food. The extracts of the experimental records are shown in Table 1.

As can be seen from Table 1, the amounts of conditioned and unconditioned secretion from both parotid glands were identical. Further in the experiment, a new stimulator was introduced — a horn to which a "right-sided" conditioned reflex was developed, reinforced by stimulating the right side of the tongue with dried meat powder.

From Table 1 it can be seen that after the introduction of the horn, reinforced by unconditioned stimulation of the right side of the tongue, the conditioned reflex for the bell increased on the right, compared with the original; the unconditioned reflex to the dried meat powder also increased on the right. To prove whether the introduction of the horn with a "right-sided" reinforcement really did produce an increase of the conditioned reflex to the bell on the right, we excluded the horn from the experiment and during the course of a week used only a bell with an unconditioned reinforcement. It was found that gradually the conditioned and unconditioned reflexes on the left and on the right became more equal and on the 4th day after the withdrawal of the horn stimulation, the

conditioned reflexes for the bell and the unconditioned for the dried meat powder became equal on the left and on the right, approaching their original amounts (Table 1).

TABLE 1

Experiments on the Dog "Belenkaya"

Time	Condi- tioned stimu- lus	Coinci- dence No.	Duration of stimu- lus (in seconds)	Unconditioned stimulation	Salivation from the parotid gland (in scale divisions)			
					left		right	
					condi- tioned	uncondi- tioned	condi- tioned	uncondi- tioned
Experiment on March 10, 1951								
11 hrs. 30 min.	Bell	60	20	Dried meat powder	15	160	14	164
11 " 35 "	"	61	20	Ditto	17	170	18	175
11 " 40 "	"	62	20	"	13	150	14	155
11 " 45 "	"	63	20	"	13	140	12	142
Experiment on March 14, 1951								
11 hrs. 20 min.	Bell	142	20	Dried meat powder	18	170	26	205
11 " 25 "	"	143	20	Ditto	17	165	28	210
11 " 30 "	"	144	20	"	19	160	27	200
11 " 35 "	Horn	112	20	Dried meat powder on the right side of the tongue	3	70	10	110
11 " 40 "	"	113	20	Ditto	0	42	10	118
11 " 45 "	"	114	20	"	0	30	13	125
Experiment on March 24, 1951								
11 hrs. 15 min.	Bell	162	20	Dried meat powder	17	170	18	172
11 " 20 "	"	163	20	Ditto	20	180	19	178
11 " 25 "	"	164	20	"	16	160	16	161
11 " 30 "	"	165	20	"	17	165	17	166

Thus, the increase of the reflexes to the bell on the right depended on the inclusion into the experiment of the horn, reinforced by an unconditioned stimulation of the right side of the tongue.

In another dog — Tsiskari — a conditioned reflex to a metronome, reinforced by dried meat powder was developed. The duration and the intervals between the stimuli were the same as for the first dog. The conditioned reflex was developed after the 20th coincidence of the metronome with the food. The reports of the experiments after the development of the conditioned reflex to the metronome are quoted (Table 2).

From Table 2 it is evident that conditioned and unconditioned reflexes to the given stimuli for both sides were of identical size. Then the metronome was excluded and a new stimulus — gurgling, reinforced by stimulating the right side of the tongue with the dried meat powder was introduced. On the 26th time of coincidence a "right-sided" conditioned reflex was developed in response to the gurgling (Table 2).

Such experiments were carried out daily during a month; the size and character of the conditioned reflex to the gurgling remained unchanged. Then the experiments were changed; the gurgling was not used and the metronome, reinforced by the dried meat powder was introduced again. It was found that then the conditioned reflex to the metronome and the unconditioned for the food on the left and on the right became of unequal size (Table 2). The conditioned reflex to the metronome remained the same on the left as before the use of gurgling, reinforced by an unconditioned stimulation of the right side of the tongue, and the reflex to the metronome on the right increased sharply. The unconditioned reflex to the food on the right also increased; on the left its size was unchanged. Such an increase of the conditioned and unconditioned reflexes on the right was observed during the course of 6 experiments. On the 7th day the predominance of the right-sided reflexes was weak and on the 8th day it disappeared.

Therefore the above-described "right-sided" increase in the conditioned and unconditioned reflexes is obviously connected with the previous lengthy application of a "right-sided" stimulus and on excluding the latter from the experiment, it gradually disappears.

TABLE 2

Experiment on the Dog "Tsiskari"

Time	Conditioned stimulus	Coincidence number	Duration of stimulus (in seconds)	Unconditioned stimulus	Salivation from the parotid gland (in scale divisions)			
					left		right	
					condi- tioned	uncondi- tioned	condi- tioned	uncondi- tioned
Experiment on February 2, 1952								
11 hrs. 30 min.	Metro- nome	40	20	Dried meat powder	17	170	16	174
11 " 35 "	"	41	20	Ditto	18	175	17	172
11 " 40 "	"	42	20	"	15	160	16	165
11 " 45 "	"	43	20	"	14	145	15	150
Experiment on March 10, 1952								
11 hrs. 25 min.	Gurgling	60	20	Dried meat powder on the right side of the tongue	0	30	10	110
11 " 30 "	"	61	20	Ditto	0	20	11	120
11 " 35 "	"	62	20	"	0	12	13	132
11 " 40 "	"	63	20	"	0	8	14	137
Experiment on April 13, 1952								
11 hrs. 20 min.	Metro- nome	62	20	Dried meat powder	16	168	30	210
11 " 25 "	"	63	20	Ditto	17	170	32	215
11 " 30 "	"	64	20	"	17	174	27	207
11 " 35 "	"	65	20	"	15	153	25	201

A lengthy application of "one-sided" (in the given case "right-sided") stimuli increases the excitability in the centres of the corresponding side, which affects the conditioned reflex to a "two-sided" stimulus. It can be considered that the above-mentioned one-sided increase of the conditioned and unconditioned reflexes takes place because, after the development of a "one-sided" conditioned food reflex, a focus of lengthy latent stimulation is formed in the cortical representation of the conditioned reflex of the corresponding side. It is correct to consider that this focus is formed in the cortical representation of the unconditioned reflex and not in the sound analyzer, since not only the conditioned but also the unconditioned reflexes of the given side are increased. Also, the sound analyzer was stimulated uniformly on both sides, whereas the focus of stimulation is formed only on the side which was subjected to the action of the unconditioned reflex.

LITERATURE CITED

- [1] Abuladze K.S., [A Study of the Reflex Activity of the Salivary and Lacrymal Glands] (In Russian) (Acad. Med. Sci. USSR Press, 1953).
- [2] Lapina I.A., [Theses of the Proceedings of the All-Union Conference of the Medical Students' Scientific Society] (In Russian) (Moscow, 1950), p. 52.
- [3] Travina A.A., Zhurn. Vyssh. Nervn. Deyat. 2, 1, 126 (1952).
- [4] Cinca Ion., Reflexul cobdionat salivar la un excit neconditional, Pevista Stintelor medicale seria, II-a Februarie 1951.