

# THE SECRETION OF BROMINE ( $\text{NaBr}^{82}$ , $\text{KBr}^{82}$ ) DURING CONDITIONED AND UNCONDITIONED SALIVATION

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Less residual solids [3], total N [5], P, Ca [6], are present in conditioned reflex saliva than in unconditioned. Only I is present in larger amounts in conditioned reflex secretion than in unconditioned secretion [6]. The mechanism of the different secretion of substances during conditioned and unconditioned salivation is not clear. In order to clarify whether the significant concentration of I during conditioned secretion depends on specific halogen properties, we studied the secretion of another halogen — Br — in the saliva.

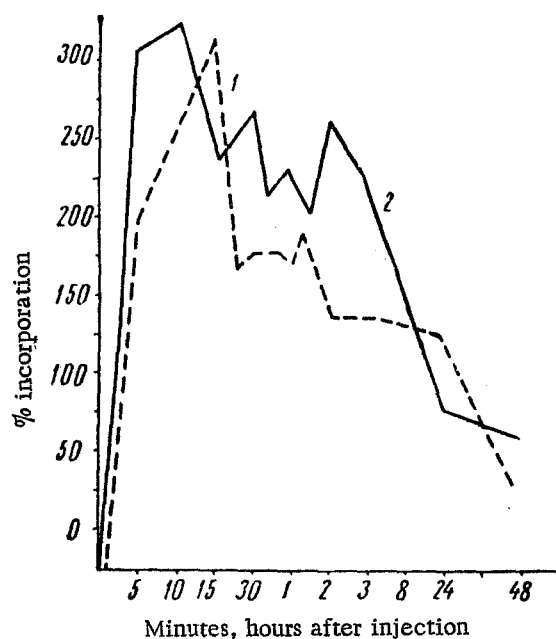


Fig. 1. Changes, with reference to time, in the percent of incorporation of  $\text{Br}^{82}$  into the blood and unconditioned-reflex saliva of the dog "Lisenok", after intravenous injection of  $\text{NaBr}^{82}$ . 1) Blood; 2) saliva.

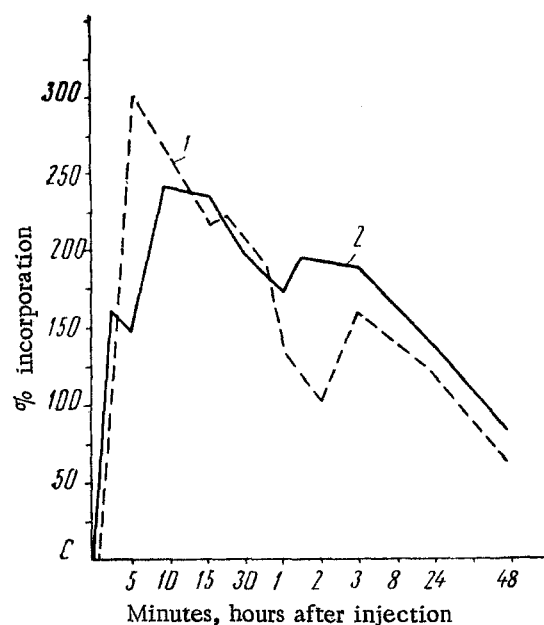


Fig. 2. Changes, with reference to time, in the percent of incorporation of  $\text{Br}^{82}$  into the blood and unconditioned-reflex saliva of the dog "Sultan", after intravenous injection of  $\text{KBr}^{82}$ .

## METHOD AND RESULTS

On the basis of many years of study of higher nervous activity by the method of conditioned reflexes to food, it was found that the dogs "Lastik" and "Sultan" exhibited a strong type of behavior; "Guidon" and "Polkan" showed an intermediate type with average strength of excitatory and inhibitory processes and satisfactory lability of the latter. "Ugadai", a representative of the intermediate type, tended toward the impulsive type; "Lisenok", "Alpha," and

"Ryzhik" belonged to the weak type. We measured the secretion of NaBr<sup>82</sup> in six of the dogs, and of KBr<sup>82</sup> in three. We introduced the bromides into the hind paw vein with an estimate of 300-1000 imp/min per 1 g. At first we studied the secretion of Br only with unconditioned salivation; two-to-three minutes following the injection we took the first portion of parotid salivation and blood from the ear vein; blood and saliva samplings were repeated at 5, 10, 15, 20, 30, 45, 60, 90, 120, 180, 480 minutes and again on the second and following days after Br administration. We then tested the saliva in conditioned and unconditioned secretion one hour later, and on the second, third and fourth day after injection. We have described the stereotype system, methods of obtaining saliva, computation of the activity of the saliva and blood in an earlier report [6]. We calculated the percent of incorporation.

Rate of Secretion of Saliva (in milliliters per minute) and Percent of Incorporation of Br<sup>82</sup> During Conditioned and Unconditioned Secretion after Intravenous Administration of NaBr and KBr

Name of dog and date of test	Time elapsed after administration of Br.	Index	Food	Bell + food	Light + food	Bell	Bell + food			
			Salivation							
			un-conditioned	conditioned	un-conditioned	conditioned	un-conditioned	conditioned (differentiated)	conditioned	un-conditioned
Injection of NaBr										
Lastik, 3/I	1 hour	Rate of secretion. Percent of Incorporation	2,15	0,10	1,20	0,04	0,80	0	0,19	2,20
Guidon, 3/I	1 hour	[ditto]	464,1	170,1	377,7	323,8	408,5	—	153,3	369,9
			0,85	0,33	1,85	0,26	1,45	0	0,30	1,68
Polkar, 23/VIII	24 hours	"	490,2	156,6	382,3	176,8	416,1	—	106,1	376,5
			1,68	0,63	1,60	0,20	1,35	0,19	0,27	1,35
Ugadai, 31/VIII	1 hour	"	50,8	46,0	52,5	41,8	83,5	48,8	39,0	59,5
			2,40	0,32	2,00	0,17	0,67 <sup>1</sup>	0,06	0,20	1,00 <sup>1</sup>
Lisenok, 16/VI	3 days	"	181,6	49,0	140,0	43,3	113,3	90,0	50,0	205,0
			1,63	0,98	1,60	0,22	1,35	0,26	0,19	1,35
Alpha, 31/VIII	1 hour	"	73,6	32,3	33,6	4,8	22,4	35,1	39,5	42,1
			1,00	0,28	0,40 <sup>1</sup>	0,12	1,35	0,12	0,17	1,35
			340,0	95,3	216,7	107,3	213,3	0	0	276,6
Injection of KBr										
Ryzhik, 30/VI	24 hours	"	1,44	0,17	1,23	0,03	1,11	0	0,03	1,50
Sultan, 15/VIII	1 hour	"	300,5	192,7	214,0	105,8	216,6	—	100,0	220,8
			1,00	0,52	0,80	0,47	1,00	0	1	1,10
Lastik, 15/VII	1 hour	"	172,5	115,3	147,2	92,6	133,9	—	—	191,5
			2,20	0,15	1,80	0,11	2,00	0,04	0,08	2,00
			271,2	160,5	256,0	151,2	188,1	147,5	211,2	356,2

\* Salivary funnel was removed during the study of secretion.

Secretion of Bromine during Unconditioned Salivation. In contrast to I, the concentration of which significantly increased in the unconditioned portions of saliva in comparison to blood after intravenous injection, the content

of Br in the saliva and blood differed relatively little;  $I^{131}$  in different portions of the saliva was from 3 to 40 times larger than in the blood [6]. After injection of  $NaBr^{82}$  or  $KBr^{82}$  the activity of the saliva rose only a little and the activity of the blood did not always rise (Fig. 1 and 2). The maximal concentration of Br in the saliva was registered in the first ten minutes after injection. Then, for an extended number of hours, the level of Br fluctuated, and gradually decreased. In the days following, its content in the saliva and blood significantly declined. Six to eight days after injection some activity was still found in these liquids.

Secretion of Bromine during Conditioned Salivation. The activity of the saliva during conditioned secretion was lower (3-4 times in individual cases) than during unconditioned salivation (See table). This relationship was clearly displayed in one hour and 24 hours after injection of  $NaBr^{82}$ . This was seen on the 3rd and even on the 4th day.

In connection with indication [1, 4] of a direct relationship between the rate of secretion of saliva and its Na content, it was possible to propose that the diminution of Br in the conditioned-reflex portion is secondary in character and depends primarily on the lowering of the concentration of the Na associated with it, in virtue of the diminished rate of conditioned secretion as compared to unconditioned secretion. To exclude the given objection, we set up tests with  $KBr^{82}$  (See table) since the level of K in the saliva does not depend on the rate of secretion [1, 4]. The activity of the unconditioned-reflex saliva was also higher in the dogs in the tests with  $KBr^{82}$ .

Hence, in all eight dogs, irrespective of which cation we used to introduce the Br, the level of the latter was lower in the conditioned-reflex saliva. It is impossible to consider this regularity as peculiar to some type of higher nervous activity since it was manifested in all of the animals.

In our tests the discharge of Br during conditioned and unconditioned secretion contrasted sharply with the discharge of I. This means that the concentration of I in the conditioned reflex saliva does not depend on I being a member of the halogen family.

The lower secretion of bromides during conditioned salivation, than during unconditioned salivation, may depend on the fact that the rate of the latter is higher. In this connection, it must be remembered that with a lowering of the rate of secretion, the level of I in the saliva increases [8]. It is also possible to explain the difference as an unequal change in the permeability of the tissues of the salivary glands with respect to Br, during conditioned and unconditioned reflexes. This is confirmed by the influence of the cerebral cortex on the permeability of the salivary glands with respect to I [7]. Furthermore, the participation of I and Br in the metabolism of the salivary glands may have a meaning of a completely different character [2, 8, 9, 11-16].

It must be emphasized, in conclusion, that the intensity of the salivary gland secretion of Br— an element which affects the course of the basic nervous processes in the large cerebral hemispheres—depends, itself, in its turn, on impulses being conducted from a higher sector of the nervous system.

#### SUMMARY

There was less bromine in the conditioned reflex saliva than in the unconditioned one in 8 dogs (with different types of the nervous activity) in an hour in 2, 3 and 4 days after the intravenous injection of  $NaBr^{82}$  or  $KBr^{82}$ . Consequently, a rise of the iodine content in the conditioned secretion in comparison with the unconditioned one (6) was not connected with the peculiar properties of the haloids. A suggestion is made on the possible mechanisms determining different saliva bromine content in conditioned and unconditioned reflexes. Blood and saliva bromine level in the unconditioned secretion were compared in 2, 3, 5, 10, 15, 20, 30, 45, 60, 90 minutes, 2, 3, 8 hours and on the 2nd and the following days after the injection. The maximum salivary level was reached within the first 10 minutes. Then a gradual reduction was noted. Salivary concentration was usually greater than that in the blood.

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All abbreviations of periodicals in the above bibliography are letter-by-letter transliterations of the abbreviations as given in the original Russian journal. *Some or all of this periodical literature may well be available in English translation.* A complete list of the cover-to-cover English translations appears at the back of this issue.

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