5. E. N. Kochina, In: Neurohumoral Regulation of the Digestion [in Russian], Moscow (1983), pp. 254-276.
6. N. N. Lebedev and Z. S. Rakhimov, In: Fundamental Problems of Gastroenterology [in Russian], Moscow (1981), pp. 150-151.
7. A. A. Fokina, and N. S. Pavlova, *Fiziol. Zh. SSSR*, No. 2, 312-315 (1978).
8. K. A. Shemerovskii, *Byull. Eksp. Biol. Med.*, No. 10, 394-397 (1978).
9. K. A. Shemerovskii, *Ibid.*, No. 9, 285-287, (1989).
10. K. A. Shemerovskii, *Fiziol. Zh. SSSR*, No. 7, 947-953 (1987).
11. T. Y. El-Sharkavy, and J. H. Szurszewsky, *J. Physiol.*, **279**, 309 - 320 (1978).
12. J. F. Erchenbrecht, J. Caspari, and M. Weinbeck, *Gut*, No. 9, 953, (1984).
13. J. B. Fozard, C. M. White, and G. R. Giles, *Gut*, No. 11, 1308 (1984).
14. K. G. Morgan, P. F. Schmalz, V. L. Go, and J. H. Szurszewsky, *Gastroenterol.*, **78**, No. 3, 405-412 (1978).
15. S. Szabo, and T. E. Bynum, *Scand. J. Gastroenterol.*, **23**, No. 1, 1-16 (1988).

0007-4888/93/0001-0012$12.50

Study of Frequency Potentiation Mechanisms of cAMP-Dependent Responses of Snail Neurons

O. V. Borisova, E. I. Solntseva, and V. G. Skrebitskii

UDC 616.8-091.8]-092.9]-073.7

Translated from *Byulleten' Experimental'noi Biologii i Meditsiny*, Vol. 115, No. 1, pp. 13-15, January, 1993
Original article submitted July 15, 1992

Key Words: *cAMP; snail neurons*

Cyclic adenosine monophosphate (cAMP) is the intracellular mediator of various physiological responses of the nerve cell. The cAMP influence on the neuron electrical activity is studied by cAMP injection into the cytoplasm through an intracellular microelectrode. It has been found on mollusks that intracellular injection of cAMP by microionophoresis or under pressure causes a short-term membrane depolarization, the mechanism of which in different neurons are connected with conductivity changes for ion channels of various types [6].

The effect of frequency potentiation of cAMP-dependent responses developing in some snail neurons has been shown during frequent multiple cAMP injections [2]. It was taken into account that this effect depends on the microionophoresis technique peculiarities, namely that the quantity of substance released from the micropipette depends not only on the injection current strength and duration, but also on the "blocking" current strength and duration commonly used between injections [1, 4]. Our experiments with switching off the "blocking" current have not yielded, however, a clear answer to the question of the interrelations of the latter with the studied effect. This led us to assume that the effect of the frequency potentiation of the cAMP responses might depend on physiological factors, notably on the stimulation of the Ca-mediated cAMP responses [3, 7], in addition to the microelectrode factor.

The present paper demonstrates the analysis of the participation of the physiological and microelectrode factors in the development of the effect of the cAMP responses frequency potentiation.

MATERIAL AND METHODS

Experiments were carried out on the B_4 and F neurons [5] of snail isolated nerve ganglia in a circulating solution: NaCl 120 mM, KCl 5 mM, $CaCl_2$ 6 mM, $MgCl_2$ 3.5 mM; pH 7.5-7.9. Recording of intracellular potentials, transmission of the polarizing current, and cAMP intracellular injection were carried out with a multibarreled microelectrode. The microelectrodes were assembled from semi-finished seven-barreled products of the WPI firm (USA). The recording barrel was filled with a 2 M sodium citrate solution. The resistance was 5-15 mOhm. The same solution was in the barrel for the polarizing current and the barrel serving as an indifferent electrode during the intracellular microionophoresis. The barrels were filled with a 0.1 M

Laboratory of Functional Synaptology (head: Prof. V.I. Skrebitskii, Institute of Brain Research, Russian Academy of Medical Sciences, Moscow (Presented by Academician O. S. Andrianov of the Russian Academy of Medical Sciences)