Correlation of Cognitive Functions with Loss of Memory and Motor Skill Learning Under Participation of Depressor Protective Mechanisms

Mikhail Poghosyan
L.Orbeli Institute of Physiology, National Academy of Sciences of Armenia
Yerevan, Armenia
e-mail:
avanecmisha@yahoo.com

Lusine Khachatryan
L.Orbeli Institute of Physiology, National Academy of Sciences of Armenia
Yerevan, Armenia

Zubeida Avetisyan
L.Orbeli Institute of Physiology, National Academy of Sciences of Armenia
Yerevan, Armenia

John Sarkissian
L.Orbeli Institute of Physiology, National Academy of Sciences of Armenia
Yerevan, Armenia
e-mail:
johnsarkissyan@gmail.com

ABSTRACT
Cognitive and central motor organization system in condition of neurodegenerative disease, connected with loss of memory and enable motor skill learning. Complex problems of modern neurophysiology are the processes of inhibition and interaction of cognitive and motor processes. GABAergic inhibition is increasingly being studied as a carrier of a much more complex and multifaceted function than a simple antithesis to excitation. The need for a wide-scale study of the participation of the GABAergic system in the protective inhibitory reactions of the nervous system is emphasized. It also turns out that the functional systems involved in the regulation of movements and cognition are often represented by the same structures of the brain. In particular, both DA and the cholinergic system provide both the performance of motor acts, and the maintenance of normal psychological and mental status of the organism. So, the basal ganglia are involved not only in the regulation of motor skills, but also in cognition.

Keywords
Cognitive – motor system of the brain, protective synaptic inhibition, neurodegenerative disease, electrophysiological and behavioral researches.

1. INTRODUCTION
In recent years, two problems related to neuroprotection of neurodegeneration, based on the inhibition of neuronal activity and the surprising interdependence of memory with cognition and motility have come to the fore in biological science, in particular in neurophysiology. In recent decades, in connection with the increase in neurodegenerative diseases (ND), the importance of disturbing the interaction of neurotransmitters in the synchronization of the operation of nerve networks has become increasingly important. At a number of NB, violations of the communicative connections of various neurotransmitter systems are shown. Deepening of depressor tetanic reactions seems to be a consequence of their nomination as a protective load in the initial stage after damage until the original ratio is restored. The literature confirms that the GABA-ergic inhibition is universal in the case of the protective tentative application of the GABA-ergic inhibition, indicating that in some systems, during the development of the nervous system, GABA influences the proliferation, migration, differentiation and maturation of the synapse, cell death and expression of the GABA receptor [7]. Moreover, modern studies at the cellular and network neuronal levels prove that synaptic inhibition cannot be evaluated only as opposed to synaptic excitation and additionally serves highly specific functions in the mammalian nervous system [3]. According to their own data, depressor reactions are more intensively involved in both nonspecific (peripheral, central) and specific (Alzheimer diseases - AD, Parkinson's diseases - PD, and others) neurodegeneration in various parts of the brain [9, 10, 14, 2]. Therefore, it is of interest to evaluate the relationship between the degree of expression and the dynamics of the growth in time of depressor and excitatory reactions, from the point of view of the success of the protective effect. In turn, the coexistence of cognition and motility is of undoubted interest, which is manifested in conditions of pathology. As specific brain regions with short- and long-term memory, the Hippocampus and Amigdala, Meynert nucleus, should be noted, respectively [1]. Basal ganglia (BG) - a series of subcortical nuclei, the function and dysfunction of which been studied as included in motor control. But recently our knowledge of these functions has been expanded to include their outstanding roles in cognition and emotional control. In a review by Nelson and Kreitzer [13], historical models of the function of BG are summarized, where recent work on animals and humans is emphasized. For example, the substantia nigra (SN), by regulating BG [12], is involved in various neurological and neuropsychiatric diseases, such as PD [5], schizophrenia [15], Pathological addictions and harmful habits [16], and, with the participation of appropriate departments of the brain cortex, triggered by glutamate in relation to structures of dopaminergic (DA) nature. This cortico-DA interaction supports the "revised" DA hypothesis of schizophrenia [15, 8], in comparison with the classical - adherent DA transmission [6]. The deterioration of higher cognitive functions, such as working memory, is one of the most invincible symptoms of schizophrenia and a strong prediction of a poor clinical outcome [11]. At the same time, we know that DA is a source of motor disorders such as hypokinesia, restless tremor, stiffness and postural instability. So, the current view of DA and schizophrenia suggests that schizophrenia can be associated with a DA imbalance involving the kurtosis subcortical DA function and a deficiency in the cortical DA function. A general model based on the glutamate regulation of DA midbrain neurons for schizophrenia is suggested by Carlsson et al. [4]. There is a correlation of motor and cognitive impairments in pathology such as PD. The neurotransmitter DA in particular, and the structure of BG, in general, are of great importance both in the performance of motor acts, and in the implementation of cognitive functions. Depletion of DA leads to a decrease in motivation, which leaves an imprint on the entire spectrum of mental and psychological

characteristics of the individual. At the same time, motor activity is reduced, including both normal motor acts, and search and orientation. Thus, there is an undeniable link between the mechanisms regulating motor and cognitive activity. This direct relationship may be another component of the puzzling question in the direction of a more comprehensive understanding of the cortical regulation of both motor BG and the DA of the reinforcing rings and can pave the way for subsequent biochemical and physiological studies.

2. RESULTS

The severity of inhibitory processes by the example of two models of special neurodegeneration – AD and PD by us has been conducted. On the model of AD, the structures of short-term and long-term memory are studied. The activity of the black substance was studied in the PD model. The tetanic and post-tetanic effects of the evoked neuronal activity were analyzed. On the model of AD after 12 w the powerful TD of NBM and Am neurons to HFS of H was found and weak in H and NBM neurons to HFS of EC (Fig. 1). On the PD model, in the absence of protection, a decrease in the multiplicity of the tetanic depression in the depressive-excitatory post-stimulus sequence (TD PTP) is determined, in comparison with the norm (1.45 versus 2.08) (Fig. 2A, Groups B, D). In another test on the same model, with the protection of Vipera Raddei (VR) with snake venom, an obvious recovery of ATP TP was shown, while without patronage it was not detected at all (Fig. 2 B). To study the effects of memory damage and orientation mechanisms, behavioral experiments were conducted. The animals were trained to reach the platform in the Morris water basin. Then one group of animals was intoxicated by amyloid Aβ25-35, the other after intoxication was subjected to immunomodulator and neurohormone PRP-1 (Proline rich peptide-1) treatment. The difference in time to reach the platform was measured. Animals treated with PRP treatment showed the best time to reach the platform. While in animals that were only intoxicated, the time to reach the platform increased significantly. Obviously the lack of spatial orientation in connection with loss of memory and cognitive assessment.

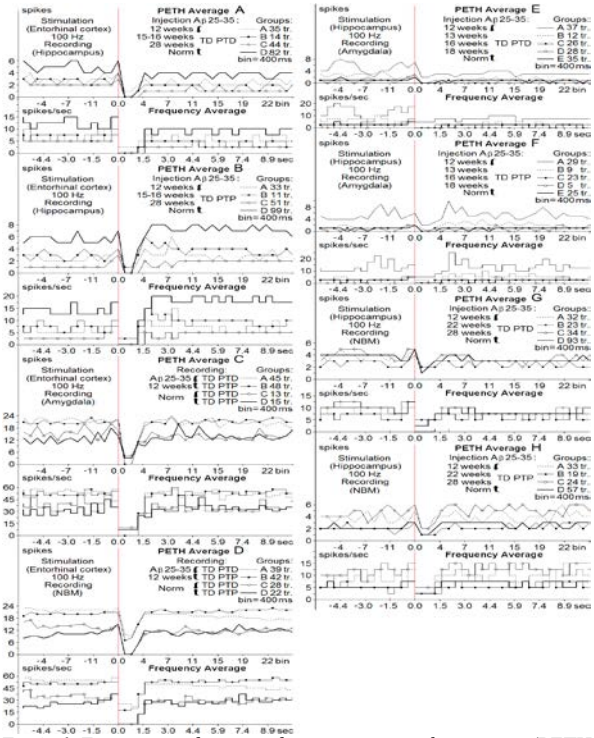

Fig.1. A-E - integrated averaged peri event time histograms (PETH Average) and frequency histograms (Frequency Average) of tetanic and post-tetanic depressor (TD PTD) and depressor-excitatory (TD PTP) spike activity of neurons in the H (A, B), the Am (C) and NBM (D) to HFS of EC, in Am (E, F) and NBM (G, H) to HFS of H compared with the norm and on AD model 12 weeks (A-H), 13-28 weeks (E-H) after the administration of Aβ 25-35. The remaining marks are in the figure.

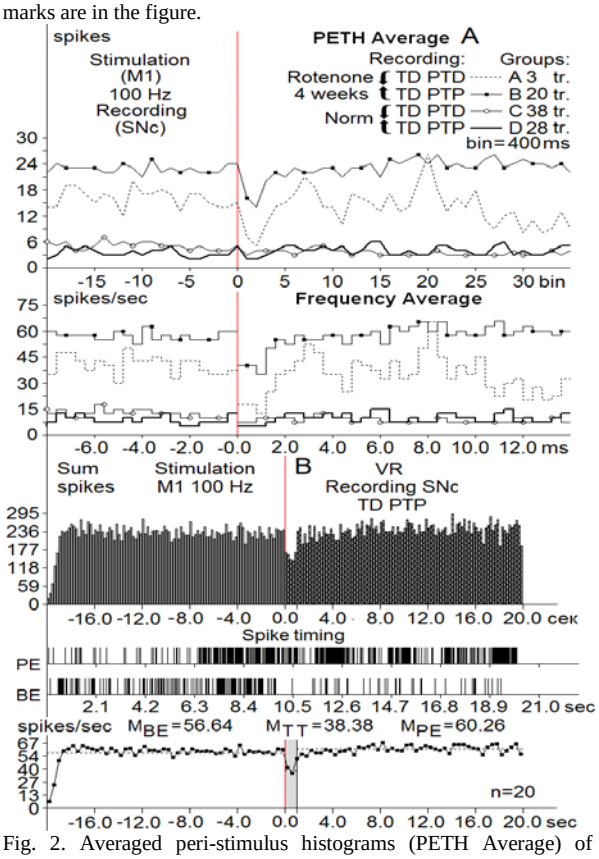

Fig. 2. Averaged peri-stimulus histograms (PETH Average) of depressor (Group A, B), depressor-excitatory (Group B, D) post-stimulus tetanic and post-tetanic manifestations of SNc neuronal activity on MFS VPNs on the BP model (Group A, B), compared with the norm (Groups B, D). B - histograms of the sum of the spikes of pre- and post-stimulus depressor manifestations of activity in combination with excitatory TD TDTs in real time for 20 sec (before and after stimulation) of neurons SNc with HFS M1 on the rotenone PD model with VR protection. Designations: diagrams of the frequency of spikes represented in histograms, with averaged values (M) for time intervals before (BE - before event), for tetanization (TT - time tetanization) and after stimulation (PE - post event). To the right of the diagrams is the number of tests (n)

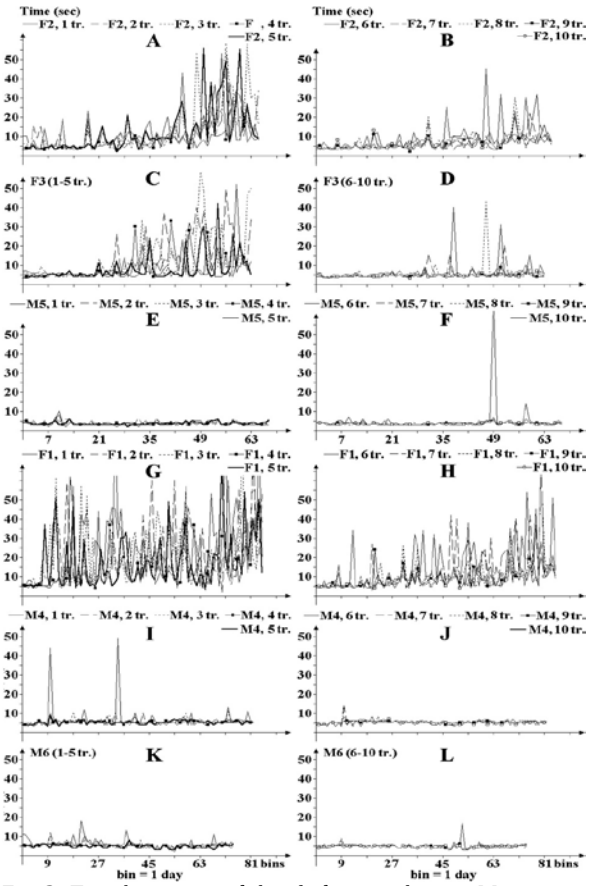

Fig. 3. Time histograms of the platform reaching in Morris water maze at 10 daily tests during next 60 to 68 days (after learning) in diseased female (F2 and F3: A, B and C, D, respectively) and male (M5: E, F) rats. Time histograms of the platform reaching in Morris water maze at 10 daily tests during next 81 to 84 days (after learning) in female (F1: G, H) and male (M4, M6: I, J and K, L, respectively) rats in conditions of regular PRP-1 administration (every other day during 4 weeks) after A_25–35 intoxication.

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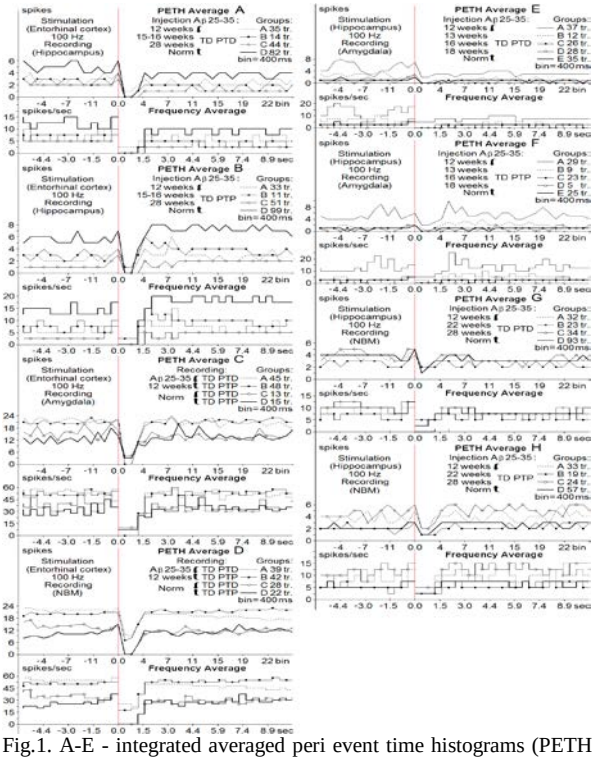

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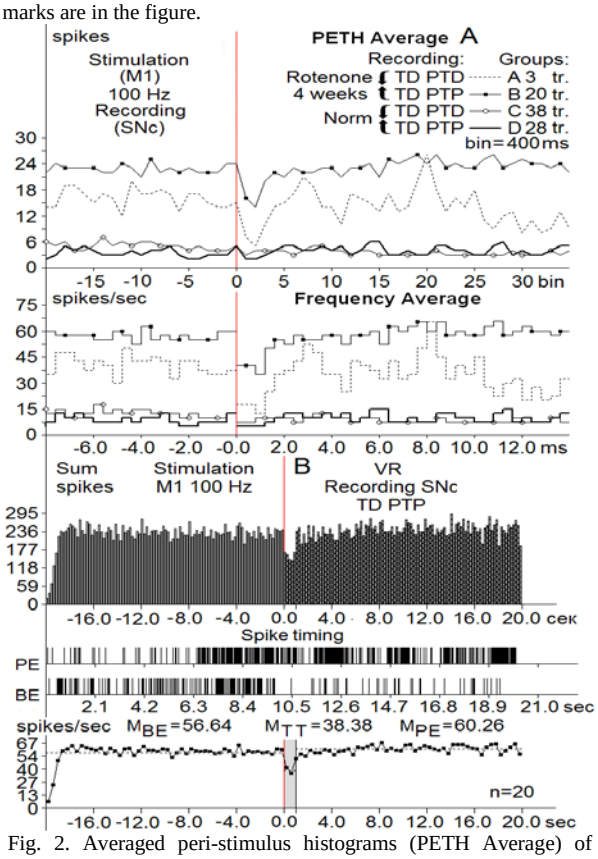

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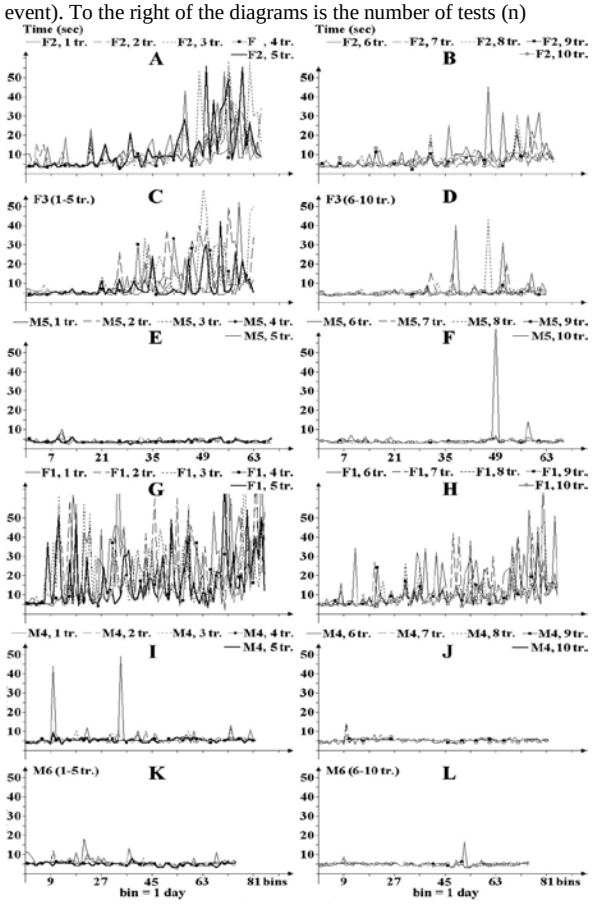

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