

International Conference on

Histochemistry & Cell Biology

September 14-15, 2016 Phoenix, USA



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Histochemistry and cytochemistry in neurochemical studies of brain and adult neurogenesis

Histochemical and cytochemical studies central nervous system (CNS) of vertebrates have made a significant contribution to understanding how specific neurotransmitter systems of brain are working. The formaldehyde-induced fluorescence (FIF) technique has been of great value because it offered, for the first time, the opportunity to map catecholamines (CAs). The FIF method was developed following the discovery that sections of formaldehyde-fixed adrenal medulla that produces CAs were fluorescent. This technique allowed labeling of catecholaminergic cells and fibers in various tissues including the rat brain. Later, the treatment of tissue with glyoxylic acid was preferentially used because it was more sensitive compared to the FIF method. Acetylcholine (ACh) is a classic neurotransmitter that is widely distributed in the CNS efferent systems, as well as in some specialized intra-cerebral systems. Until the 1980s, quantitative biochemical assays for ACh and choline acetyltransferase (ChAT) and histochemical techniques for acetylcholinesterase (AChE) were the methods used to locate putative cholinergic neurons. Histochemical methods for determining AChE revealed a number of putative cholinergic somas and fibers in the CNS of vertebrates. Nitric oxide (NO) has recently been shown to play a fundamental role in the development and plasticity of the central nervous system CNS, during both embryonic and post-embryonic life stages. Histochemical identification NO-ergic neurons with using NADPH-diaphorase allowed study topography and morphology of the NADPH-d positive neurons and nuclei in the CNS of vertebrates. Thus, neuro-histochemical and cytochemical studies have to describe structure, localization, topography and connections of various neurotransmitter systems, become the first step in investigation of neurochemistry of brain. Currently, a unified view to physiological mechanisms of integration of different neurotransmitter modulating systems in fish brain is not formed. The results of study different species of teleost fish showed significant intergroup differences in organization as a nonspecific (dopaminergic, cholinergic, etc.), and specific afferent projections in forebrain. The signals coming from the so-called non-specific systems of brain have often role of secondary neuromodulators, initiating a long plastic reconstructions of inter-neuronal interactions, providing a direct connection between sensory and motor centers, during creating of motor programs of behavior. The ascending systems of brain activation in teleost fishes have essential features associated with the organization of sensory systems and their central projections, a predominance of one or another types of analyzers, wide adaptive radiation, low level of brain cephalization, as well as special type of CNS histogenesis. Objective of our work is to investigate the organization, projection features and relationships of signal transduction systems, producing classic neurotransmitters (catecholamines, acetylcholine, gamma-aminobutyric acid) and gaseous intermediates (nitric oxide and hydrogen sulfide), in fish brain and evaluate their participation in the processes of adult neurogenesis of the CNS.

Biography

E V Pushchina has completed her PhD from Far East State University and Post-doctoral studies from A V Zhirmunsky Institute of Marine Biology-RAS. She is the Professor and Leader Researcher of Lab. Cell differentiation of IMB FEB-RAS, a premier organization of National Centre of Marine Bio-research-RAS. She has published more than 35 papers in reputed journals and has been serving as an Editorial Board Member of reputed.

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