2. Abstract

The aim of my study was to identify specific features of the structure and function of neurons in the auditory cortex of rat and to analyze age-related changes in the inhibitory system (GAD 65 and 67) in the central auditory structures of the same species. Based on the findings in the animal model we focused on changes in the central part of the auditory pathway and auditory cortex in aging human population that were examined by various MRI techniques (spectroscopy, morphometry, diffusion tensor imaging and functional MRI).

We found that the most significant feature of neurons in the auditory cortex is the presence of the hyperpolarization-activated cation current that influences functional properties of neurons. The differences among neurons in different fields of the AC were based on their specific functional characteristics, with the tonotopy being the key factor of the AC structural organization.

Aging of the auditory system has a negative influence on the speech understanding in which the processing of temporal parameters of the sound plays a significant role. In animal experiments we observed decreases of the enzymes GAD65 and 67 (that catalyze synthesis of the main inhibitory neurotransmitter GABA) in central parts of the auditory system. Inhibition is the key factor in coding and decoding of temporal parameters of sound. On the basis of audiological examination our group of elderly subjects was divided into two groups (EP- expressed presbycusis, MP- mild presbycusis). In elderly, the spectroscopy showed decreases in the level of glutamate and N-acetylaspartate, with no clear changes in the inhibitory transmitter GABA, however, there was present an increase in the level of lactate in the EP group. Morphometry and DTI findings supported the effect of aging on central structures of 7

the auditory system without any significant effect of the level of hearing loss. Functional examination of the AC with fMRI showed similar trends in aging demonstrated by increased activation of the AC in comparison with young volunteers. Aging also led to an increased use of the right AC, which was more active compared to the left AC. However, the results of the fMRI again did not show any central effect of the hypofunction of the auditory periphery.