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α2B-Adrenoceptor expression in cells of the tree shrew (Tupaia belangeri) thalamus: Co-Localization with GABA- and glutamate-like immunoreactivity

The catecholamine noradrenaline mediates effects of stress and disturbances in the noradrenergic system have been implicated in depressive disorders. Cellular effects of noradrenaline are, among others, mediated by α2-adrenoceptors (α2-ARs). Subtype specific mRNA of α2-adrenoceptors is expressed in distinct but overlapping areas of the mammalian central nervous system, suggesting different functions in vivo. Messenger RNA (mRNA) for the α2B-AR has been reported to be strongly expressed in the thalamus, a structure intimately involved in sensory processing and arousal. The aim of the present study was to identify the type of thamic cell(s) expressing α2B-adrenoceptor mRNA. Immunohistochemistry for GABA and glutamate was combined with in situ hybridization (ISH) using both 32P- and digoxigenin-labeled riboprobes specific for α2B-adrenoceptor mRNA on coronal sections of the tree shrew brain.

Only ISH using 32P-labeled riboprobes was successful in visualizing α2B-adrenoceptor gene expression. The strength of the ISH signals was determined semi-quantitatively. There were strong ISH signals in the thalamus, but also in several extra-thalamic areas, such as cerebral cortex and hippocampal formation. Size and shape of the α2B-AR expressing cells indicated that they were not glial cells. In the dorsal thalamus, GABA-like immunoreactive (GABA-LI) cells showed no ISH signals for α2B-AR expression. In contrast, strong ISH signals were found over GABA-LI reticular nucleus cells of the ventral thalamus. Many glutamate-like immunoreactive (GLU-LI) cells throughout the dorsal thalamus showed ISH signals. As GABA immunoreactivity is regarded as a marker of GABAergic neurons, and most GLU-LI cells exhibited morphology of glutamatergic neurons, it is concluded that many thalamo-cortical and cortical glutamatergic neurons express mRNA for the α2B-AR. The GABAergic system of the thalamus turned out to express α2B-AR mRNA only in cells of the reticular nucleus, but not in interneurons. This is an interesting finding since the thalamic reticular nucleus and thalamo-cortical cells are thought to interact in the generation of thalamo-cortical oscillations.