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Application of immunocytochemical, immunohistochemical and morphological methods for the investigation of the distribution and potential significance of various K^+ channel subunits

K^+-permeable transmembrane proteins (K^+-channels) play important roles in physiological and pathological processes of both excitable and non-excitable cells. As the consequence of their electrogenic functions, they are essential in regulating the excitability of the cell surface membrane and thus they regulate the timing of action potentials. Moreover, based upon the most recent experimental data, they are important in regulating pro- and anti-apoptotic processes, too. It is not surprising, therefore, that the examination of the presence and distribution of the various K^+-channel types might significantly contribute to our precise understanding of the functions of structures they are expressed in and to the proper interpretation of certain pathological mechanisms.

The very first station of the auditory information processing occurring in the brain stem is the cochlear nucleus. In the first part of the present study, the presence and distribution of various types of voltage-gated K^+-channel (Kv) subunits have been studied in the bushy neurones situated in this structure. The experiments were carried out on either enzymatically isolated neurones or free-floating slices by applying immunochemistry and functional investigations. According to our experimental data, bushy neurones express several types of K^+ channel subunits (such as dendrotoxin sensitive, delayed rectifier and rapidly inactivating Kv-subunits as well as TASK-1 channels), which can partly account for the extremely complex firing behaviour characteristics of these cells. The presence of transient current producing subunits was confirmed by applying highly specific channel blockers. In addition, we also performed the specific labelling of cochlear nucleus neurones, and we established morphological clues allowing their more reliable identification. Moreover, we demonstrated that Purkinje-like cells of the cochlear nucleus project into the cerebellum.

In the second part of this work we tested and validated a novel, human TASK-3 specific monoclonal antibody by employing immunocytochemical and immunohistochemical methods. Besides the documentation of the specificity of the antibody and determining the optimal conditions for the immunochemistry we also showed that human melanoma malignum cells display a strong, mainly intracellularly distributed TASK-3 immunopositivity. The experiments carried out on melanocytes indicated that TASK-3 expression is not only confined to malignantly transformed cells, thus it is not suitable to distinguish between benign and malignant processes of melanocytic origin.