Thesis: Calretinin immunoreactivity in the prefrontal cortical region of the rat brain

The prefrontal cortical area is the center of cognitive and executive functions. This area is reciprocally associated with many other CNS structures and in particular with the thalamus and limbic system structures. These connections provide a number of functions, such as working memory, social and purposeful behavior, emotional memory, attention and decision-making. The prefrontal cortex of the rat brain is divided into three agranular fields covering the medial, insular and orbital areas of the rostral part of the hemisphere. The medial prefrontal cortex (prelimbic, infralimbic, anterior cingular area) serves a number of somatic and autonomic functions. Each cortical area contains 70–80% of excitatory (glutamatergic) neurons and 20–30% of inhibitory (GABAergic) interneurons. The most functionally important groups of GABAergic cortical interneurons are populations expressing calcium-binding proteins, i.e. parvalbumin (PV), calbindin (CB) and calretinin (CR). Calretinin positive GABAergic interneurons represent 12–20% of the total population of cortical GABAergic intrerneurons. It is a heterogeneous population that differs in somatodedritic morphology and functional characteristics. Recently, there has been increasing evidence that decrease in neurons expressing calcium-binding proteins, including CR+ interneurons, or decrease in the expression of these proteins are associated with increased neuronal vulnerability and increased neural network excitability. These changes have been described in clinical trials and experimental models of amyotrophic lateral sclerosis, epilepsy and schizophrenia. An important feature of CR+ cortical interneurons is their termination on other inhibitory interneurons. This type of involvement leads to disinhibition of projection excitatory neurons and to fundamental changes in the functional architecture of neural networks. Knowledge of the distribution and morphological characteristics of CR+ interneurons is necessary to interpret their functions.
The aim of the proposed project is to analyze the distribution of CR+ interneurons in the cytoarchitectonic areas of the prefrontal cortex of the rat brain (Wistar). The analysis will focus on the laminar distribution of these neurons and their somatodendritic morphology. The subject of evaluation will be morphological characteristics of cell bodies (form factor), staining intensity, length and orientation of dendritic segments. Laminar densitometric characteristics will be determined for each area. Measurements will be performed on coronary sections of the hemisphere (40 μm). Detection of CR + interneurons will be performed on material processed by a standard immunohistochemical method using a monoclonal anti-CR primary antibody.