SUMMARY

Introduction: There are two main cell types in the human and animal nervous system: neurons and their associated glial cells. Correct communication between them is essential for the proper functioning of the brain. Oligodendrocytes constitute the most numerous population of glial cells in mammals. Their main function is the production of myelin, which determines the quick and efficient conduction of nerve impulses along the nerve processes. The presence of iron in oligodendrocytes and their location in the vicinity of the nerve fibers, blood vessels and neurons supports the participation of these glial cells in the metabolism of this element as well as the metabolism of neurons. The importance of oligodendrocytes in pathological conditions has not yet been fully understood, and their dysfunctions are observed in many neurodegenerative diseases.

Aims of the study: Analysis of the location and morphology of oligodendrocytes and the presence of iron in these cells, regarding the areas of weakly and highly myelinated brain of chinchillas (latin: *Chinchilla lanigera*).

Material and methods: Areas with a predominance of gray matter were examined, i.e. cerebral cortex (Latin: *cortex cerebri*), hippocampus (Latin: *hippocampus*) and periaqueductal gray matter (Latin: *substantia grisea centralis*) and with a high content of myelinated nerve fibers i.e. corpus callosum (Latin: *corpus callosum*) and internal capsule (Latin: *capsula interna*). In order to determine the location of oligodendrocyte specific areas of the central nervous system are used by impregnation with silver salts of neural tissue by Ogawa. For the determination of iron distribution in oligodendrocytes, histochemical method was used detecting the presence of iron ions by LeVine. In order to determine the position of the examined areas of the brain, to evaluate the distribution in their oligodendrocytes and morphometric analysis test cells Nissl method was used. Furthermore, in order to confirm their location immunofluorescent staining using anti-specific myelin basic protein (MBP) was performed.

Results: In the cerebral cortex, hippocampus and periaqueductal gray matter, oligodendrocytes occur singly or in pairs, usually in the vicinity of blood vessels and neurons. Oligodendrocytes in sections of hippocampus and cerebral cortex had irregular arrangement. The corpus callosum and the internal capsule, oligodendrocytes were arranged in rows, seen between myelinated nerve fibers. The observed distribution of tested cells in the applied methods used were similar. Our findings had shown approximately four times the higher density of oligodendrocytes, in highly myelinated areas, which are rich in nerve fibers compared to the poorly myelinated areas. The morphometric analysis included the following parameters: length (μm), width (μm),

circumference (μm), diameter (μm), and surface area (μm²) did not differ significantly between the study areas of the chinchillas brain.

Conclusions:

1. Arrangement of oligodendrocytes in the cerebral cortex of chinchillas is uneven. Their higher density occurs in its deeper layers, closer to the white matter.

2. Oligodendrocytes in the hippocampus of the small chinchilla (Latin *Chinchilla Lanigera*) are unevenly. Their highest density was reported in the CA2-CA3 hippocampal fields.

3. In the periaqueductal gray matter of the small chinchilla (Latin *Chinchilla Lanigera*) oligodendrocytes are distributed singly or in pairs. They were mainly located near the bodies of neurons and blood vessels

4. In the corpus callosum and in the internal capsule of of the small chinchilla (Latin *Chinchilla lanigera*) the oligodendrocytes show a characteristic serial arrangement.

5. The distribution of oligodendrocytes in selected areas of the brain of the small chinchilla (Latin *Chinchilla lanigera*) was similar in all methods used.

6. The density of oligodendrocytes in selected areas highly myelinated at a chinchilla was approximately four times higher than in weakly myelinated areas.

7. Analyzed morphometric parameters of oligodendrocytes ie. length (um) width (um), the perimeter (μm), the diameter (μm), circumference (μm), and surface area (μm^2) were not significantly different between the areas of the brain examined in chinchillas

Key words: oligodendrocytes, glial cells, myelination, small chinchilla