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Morphological analysis of the Hippocampal region of aged rats, role of Clasmatodendrosis

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Clasmatodendrosis is a phenomenon first described by Alzheimer in 1910, which was observed in aged nervous system and in the course of neurodegenerative diseases. It consists in the loss of astrocytic distal processes. The occurrence of clasmatodendrosis is frequently associated with an increase of autofluorescent aggregates in different cell types of nervous tissue. In this study we designed a calibrated excitation/emission method of spectral unmixing aimed to discriminate the fluorescence emitted by commercial fluorochrome-conjugated antibodies from the autofluorescent signal, by using confocal microscopy and multiphoton fluorescence lifetime imaging techniques. By this method, the immunolabeled GFAP localization in the CA1 Hippocampal region of aged rats was analyzed. Autofluorescent debris showed a strong positivity to GFAP labeling, suggesting that the detached fragments of clasmatodendrotic astrocytes might take part in the generation of these structures.

By 3D confocal analysis we found that these aggregates, were located on neuronal cell surfaces, as well as inside the soma and that, in addition, the presence of autofluorescent aggregates seemed to be related with increased adhesion phenomena among neurons. These data were compared with those obtained in control adult rats and in rats infused with lipopolysaccharide (LPS) in the 4th ventricle to induce a chronic inflammatory state. The presence of autofluorescent aggregates was detected in LPS rats and also in control rats, even if they appeared smaller and with a lesser intensity as compared with the aged rats. These findings suggest that clasmatodendrosis is a process involving the interaction of neurons and astrocytes in a prolonged timespan of life. Its severity increases with aging or under inflammatory and/or neurodegenerative diseases. In conclusion, our results seem to suggest that clasmatodendrosis can affect neuron functionality not only due to a decreased astrocyte activity, but also by direct interaction of the detached astrocytic fragments with neuron somata.

Key words
Clasmatodendrosis, aging, autofluorescence, confocal microscopy.