Researches on neurodegeneration using techniques based on synchrotron radiation

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The most frequently cited theories of degeneration and atrophy of neurons in neurodegenerative disorders are oxidative stress, excitotoxicity, protein aggregation, and mitochondrial dysfunction [1-5]. In all of this processes metal ions play a very important role. As it is also known, in most cases trace metals in tissue are bounded into metallo-organic complexes [4]. The mechanisms mentioned above lead to changes in main bio-organic components such as nucleic acids, lipids, proteins, etc. Moreover, the disruption of intracellular homeostasis is reflected by the products of these abnormal reactions or by intensive production of the defense system factors (such as antioxidants) [5]. Comparison between distribution of elements and organic components including the relative secondary structure composition of the protein compounds in the tissue at the single cell level may shed some light on processes leading to neurodegeneration. Two neurodegenerative disorders i.e. Parkinson's disease (PD) and amyotrophic lateral sclerosis (ALS) were investigated with the use of synchrotron radiation microbeam. The autopsy samples of selected parts of brain and spinal cord were studied. The synchrotron micorobeam X-ray fluorescence technique (micro-SRXRF) was used for topographic and quantitative analysis of selected elements. The evaluation of Fe and Cu chemical state in the neuron was performed with the use of microscopic X-ray absorption near edge structure spectroscopy (micro-XANES). The synchrotron Fourier transform IR microspectroscopy (SR-FTIR) was applied for investigation of the biochemical components of the tissues, as well as the relative secondary structure composition of the proteins.

References:

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