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Differential Scanning Calorimetry – Method for Detection of Neurodegenerative Diseases

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Introduction: Differential scanning calorimetry (DSC) is a method for thermal analysis used to characterize the stability of biological macromolecules in their native conformations. DSC measures the heat capacity difference between the sample and the reference material in temperature scans. It is a highly sensitive method which is capable of detecting compositional changes in the molecular and supramolecular profiles of affected by disease tissues. In this work, DSC was used to characterize the thermal properties of brain tissues isolated from experimental animals (mice) with scopolamine-induced dementia of Alzheimer's disease (AD) type. Neurotensin (NT) is a neuropeptide and putative neurotransmitter which is expected to hold up the development of some neurodegenerative diseases (NDD).

Aim: To assess the DSC potential as a method for detection of NDD in animals with drug-induced dementia of AD type and to evaluate the NT preventive effect on the disease progression.

Methods: Experimental model of dementia of AD type was created using male Albino mice via central neuronal/neurotransmitter pathways manipulation with scopolamine (1 mg/kg, i.p., 11 days) and was verified by cognitive and biochemical tests. NT was applied for 11 days simultaneously with Scopolamine. On the 24th hour after the last treatment, DSC measurements were performed on brain tissue homogenates of healthy, demented and NT-treated animals using a Nano DSC (TA Instruments, USA).

Results: Distinctive differences between the heat capacity profiles for healthy and demented animals were found. The heat capacity profiles of NT-treated mice differ significantly from those for animals treated with scopolamine alone and resemble the thermograms for healthy animals (controls). Finally, the differences in the thermograms from the three groups of mice correlate with the cognitive changes determined by behavioral tests.

Conclusion: DSC is a useful method for obtaining information on the disease mechanisms at molecular level and for diagnosing of NDD. It is also appropriate for detection and characterization of the compositional changes taking place in AD brain tissues and could be helpful in further studies on neurodegenerative diseases.