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Thank to newly developed methods related to chromosomal conformation capture, researches were able to elucidate principles of chromatin folding. The aforementioned studies were carried out primarily on proliferating / transformed cell lines, however up to date, very little is known about the spatial organization of the genome of the cells, which are terminally differentiated like neurons. 3D chromatin architecture may be particularly important in these specific, long- living cells, in which stimulation by external signals induces dramatic change in gene transcription. The general objective of the presented proposal is to map genome-wide chromatin interactions involved in the activity- driven gene expression. Our preliminary data indicate that upon stimulation of neurons, chromatin undergoes local condensation. We hypothesize that changes to chromatin architecture induced by neuronal activation might be critically involved in the molecular mechanisms regulating activity-dependent gene expression, and hence memory persistence and cognition. Therefore we would like to elucidate the molecular mechanism and biological significance of chromatin condensation upon neuronal stimulation and show the implications of activity- dependent chromatin condensation loss on animal behaviour. We hope to define some of epigenetic events that underlie neuronal plasticity and unravel unrecognized role of the neuronal nuclear architecture in brain plasticity.

The epigenetic modification of the chromatin can have long-lasting effects in neuronal gene expression and function and thereby represents an attractive and still largely unexplored molecular substrate for neuronal plasticity and durable changes in behavior, like long-term memory. Furthermore, transcriptional deregulation and abnormal chromatin remodeling seem to underlie a number of important mental disorders, including congenital cognitive impairment syndromes, schizophrenia and neurodegenerative diseases. Therefore the results obtained within this project will provide a novel and original knowledge about the structural dynamics of neuronal chromatin in the context of gene expression involved in neuronal plasticity.