Abnormal reaction to novelty in NRXN-1 knock-out mice revealed with EEG-behavioral phenotyping

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Aims. More than 100 neurological and psychiatric deceases are believed to be caused by abnormal work of synapses - synaptopathies. The aim of our study was to assess the possible role of NRXN1 gene in brain's functional activity of mice at behavioral and system levels. This gene codes one of the presynaptic proteins. In humans mutations in NRXN1 are associated with the autism and other cognitive disorders.

Methods. We have recorded the EEG from prefrontal and parietal electrodes using small wireless recording device Neurologger (NewBehavior AG) in freely behaving mice (controls and NRXN1 mutants) during several standard behavioral tests: open field, novel object exploration, social interaction. Movements were tracked and synchronized with the EEG traces.

Results. NRXN1 mutants had greater amplitudes of EEG high-frequency bands (>20Hz) in all tests, which may indicate greater arousal associated with the exploration of novel territory or objects. This between-group difference reduced with the habituation of the animals to experimental conditions. Presentation of non-social novel object lead to the increase of the peak frequency in theta band in controls but not in mutants, which may indicate the lack of hippocampal activation related to the exploration of new objects in NRXN1 mutants. Remarkably, the mutants demonstrated extremely greater than controls behavioral interest in the exploration of novel objects after the stimulus onset but not at the end of the test.

Conclusions. Our results indicate altered brain processing of environing novelty in neurexin lacking mice.