

## MSc-project

### Investigating cross-frequency couplings in brain circuits relevant in depression and schizophrenia

#### Introduction:

Major depressive disorder, affecting 3% of the world's population, and schizophrenia are debilitating disorders which may cause suffering and reduce the ability to function in life. There is a large unmet need for better treatments since many patients do not respond well to existing medications. It is important in drug-development to find objective neurobiological measures/biomarkers reflecting the aberrant brain signaling implicated in the disorders. Cross-frequency couplings have been found cognitively relevant and are affected in schizophrenia. Furthermore, alterations in (specifically) phase-amplitude couplings between theta and gamma/HFO oscillations in hippocampus has been shown to be altered by the NMDAR antagonistic drug, ketamine, which at high doses mimic schizophrenia and at lower doses expresses anti-depressive effects.

#### Objective:

To explore the effects of NMDAR antagonistic compounds on phase-Amplitude coupling and potentially other types of cross-frequency couplings. Particular interest lies in unexplored couplings to oscillations of very high frequency which are dramatically affected by several types of NMDAR antagonistic compounds.



<https://s3-us-west-2.amazonaws.com/prodengblogs/assets/2016/01/brain.png>

#### Description:

Measures for phase-amplitude coupling and potentially other types of cross-frequency couplings should be derived from local-field-potentials recorded at intra-cranial electrodes surgically implanted in live rats to evaluate any effects of two NMDAR modulating compounds. The investigations should include simulation studies to elucidate weaknesses in proposed measures for cross-frequency couplings in order to determine the best measures to use. The project has potentials for affecting improved methods for drug development. The project is associated with the pharmaceutical company H. Lundbeck A/S.

**Max number of students:** 1

#### Prerequisites:

Signal processing, mathematical and statistical skills, profound experience in Matlab

#### Supervisors:

Assoc. Professor MSK PhD Helge B.D. Sørensen, DTU Elektro

Industrial PhD Ingeborg Helbech Hansen, DTU Elektro and H. Lundbeck A/S

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