Visuo-vestibular interactions in spatial orientation circuitry

The presubiculum is a defined cortical area, located at the transition between hippocampus and entorhinal cortex. Presubicular neurons are sensitive to head-direction, and they fire specifically when the head of the animal is oriented in their preferred direction. In this way, and in association with the place cells, they contribute as a sort of compass to hippocampal function in spatial behaviours. The presubiculum may be well suited to update a directional signal of vestibular origin with visual information, and recent evidence indicates that it provides direct input to the entorhinal grid cells. How the microcircuit integrates head-directional information and how it computes output is unknown.

During this project, the candidate will investigate in vivo in alert mice the interactions between these 2 essentials sensory modalities, using a combination of electrophysiological techniques together with behavioural stimulation. First, the candidate will record single neurons in the presubiculum while rotating the animal on a vestibular turntable to correlate their firing rate with the direction of the head. Second,
using optokinetic stimulation, the response of the neurons to visual inputs will be characterized in the absence of movement. Finally, a combination of coherent or mismatched vestibular and visual stimulation will be used to determine how head-direction neurons integrate such multisensory information.

The candidate, biologist or engineer, should have a background in Biology&Neuroscience. A previous experiment with in vivo tests, and a fair knowledge with signal processing and informatics tools would be a plus.