Vestibular Loss and Spatial Orientation (VELOSO)

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The sense of orientation in space is crucial for survival and navigation in the environment. The brain derives spatial orientation from (1) self-motion signals originating in the vestibular system of the inner ear and (2) visual signals encoding orientation relative to external landmarks.

Loss of vestibular function, which occurs with 7.4% lifetime prevalence (Agrawal et al., 2013), degrades both the perception of orientation in space and the capacity to navigate even in familiar visual environments. We will ask why and how vestibular dysfunction affects the use of visual cues as landmarks in spatial orientation. We hypothesize that cross-modal integration is degraded; vestibular deficits prevent the brain from binding visual landmarks to particular orientations, thus impeding navigation even in familiar visual environments.

Our consortium proposes work in rodent models and non-human primates. We have expertise on the consequences of vestibular deficits, in vivo recordings of neurons in the brain's navigation system, sensory interactions, neuronal circuits and modeling. Anatomical, physiological and theoretical approaches will let us ask how vestibular deficits compromise the sense of spatial orientation. Our results will serve translational initiatives to help improve diagnosis and develop novel re-education strategies for patients with vestibular dysfunction."