Modeling the Olfactory Bulb - Coupled Nonlinear Oscillators

Authors: Zhaoping Li, John J. Hopfield

Abstract: The olfactory bulb of mammals aids in the discrimination of odors. A mathematical model based on the bulbar anatomy and electrophysiology is described. Simulations produce a 35-60 Hz modulated activity coherent across the bulb, mimicing the observed field potentials. The decision states (for the odor information) here can be thought of as stable cycles, rather than point stable states typical of simpler neuro-computing models. Analysis and simulations show that a group of coupled non-linear oscillators are responsible for the oscillatory activities determined by the odor in(cid:173) put, and that the bulb, with appropriate inputs from higher centers, can enhance or suppress the sensitivity to partiCUlar odors. The model provides a framework in which to understand the transform between odor input and the bulbar output to olfactory cortex.