

Modeling of the Odor Information Processing in the Mammalian Brain

I.Valova, N. Georgieva, Y. Kosugi

Our aim is to simulate the dynamic behavior of the olfactory bulb as part of the olfactory system. Olfactory EEG have revealed that oscillation and chaos play important roles in the processing of information in the bulb[1]. We have based our model on coupled nonlinear oscillators, which resemble groups of mitral and granule cells as main building units. The model involves excitatory mitral and inhibitory granule cells, forming a non-linear oscillator. Several of these oscillators are coupled in two layer architecture. The system exhibits complex oscillatory behavior, simulating mammalian olfactory bulb. Results for two different types of input are considered. Simulations show that the dynamic behavior of the model is stable under the influence of noise. The model bulb responds to different odor input with spatio-temporal activation patterns, which are unique for each simulated odor. After inhalation has started, a burst of oscillatory activity emerges. The specific pattern of oscillation, which is exhibited by the bulb model, is coherent over the whole bulb.