**Temporal dynamics of receptor neuron input to the olfactory bulb of behaving rats**

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We have previously demonstrated that the dynamics of olfactory receptor neuron (ORN) input to the olfactory bulb can encode odorant information and are shaped by sniffing in anesthetized mice (Spors et al., 2006). To test whether this occurs during natural sniffing, we trained head-fixed rats to discriminate between odorants, then imaged presynaptic calcium signals (indicative of ORN firing) during odor discriminations. Slow sniffing (< 2.5 Hz) evoked brief bursts of ORN input that were phase-locked to each sniff. We measured parameters of the sniff-evoked calcium response in each glomerulus, such as latency (sniff peak to 50% of the peak response: 117 ± 45 ms; reflects the delay from odor sampling to bulbar input), rise time (10 - 90% of the calcium response: 119 ± 71 ms; reflects the temporal spread of ORN firing), and decay time. As in anesthetized mice, calcium response dynamics differed among glomeruli and for different odorants and concentrations, but remained uniform within a glomerulus for a given odorant and concentration. These dynamics occurred mostly within the time from the earliest calcium response to the behavioral response (~440 ms). Phase-locking between calcium signals and sniffing did not occur during fast sniffing (> 4 Hz); as frequency increased, responses became desynchronized from sniffing. These data suggest that odorant information can be encoded by the temporal properties of receptor input to the olfactory bulb, and that this encoding can be modulated by sniffing frequency.

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