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Correlated glomerular convergence and latency coding of odors in mitral cells

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Behavioral responses to olfactory stimuli can happen after less than half a second after stimulus arrival. Given ORN spike rates in the order of 0 to 15 spikes/s it appears unlikely that average spike rates play a major role for the detection of the odor and the bahavioral response to it. We therefore assumed the other extreme, i.e. that the first spike of an odor response of a mitral cells is important for detection and quality coding (which does not exclude other effects). Using activity contrast imaging (ACI, [1]) we could indeed show that the response latency vectors code odor quality with high fidelity [2] in virtually synchronous ensembles of mitral cells [3]. We hypothesize that the first spike of a mitral cell is somehow induced by correlated glomerular input. This view is strengthened by the existence of bifurcations in ORN axons so far seen in Xenopus [4] and mice [5]. Such bifurcations obviously lead to hardwired correlations in an ontogenetical situation where, due to a relatively low number of axons, stimulus-induced, correlated ORN activities are sparse or absent.

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