Abstract View

DYNAMICAL DECORRELATION OF ODOR REPRESENTATIONS IN THE LOCUST ANTENNAL LOBE

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Odor stimulation evokes complex stimulus-specific spatio-temporal patterns of activity in the projection neurons (PNs) of the locust antennal lobe (AL). These patterns, consisting of fast (20-30Hz) oscillations superimposed upon a slower temporal structure of alternating depolarizing and hyperpolarizing epochs, result from intrinsic dynamic network properties activated by the presentation of odorants. These dynamics have been shown to optimize odor representations and thus contribute to odor discrimination. In zebrafish the slow temporal patterning in mitral cells appears to play a major role in the decorrelation of odor representations [Science: 5505:835, 2001]. Here we tested with a computational model the hypothesis that locust AL intrinsic dynamics can serve a similar function. Upon odor presentation, fast (about 20 Hz) field potential oscillations emerged and were maintained by interactions between excitatory PNs and inhibitory local neurons. When similar odors were presented, the response patterns of PNs strongly overlapped at first. After a few hundred msec, however, the overlap between similar odor representations was reduced and the initial clusters of activated PNs disappeared; cross-correlations between PN activity patterns were reduced by 30-50%. The correlations increased again following the brief activity increase occurring after stimulus termination. Thus, our model predicts that intrinsic dynamic properties emerging from interactions of PNs and LNs can amplify small differences between similar odors, thus improving odor discriminability.
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