Neural basis of general odor processing in the cockroach antennal lobe

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The cockroach *Periplaneta americana* is equipped with excellent capabilities of olfactory discrimination and learning. However, little is known about the neural basis of the odor representation. Olfactory receptor neurons (ORNs) in antennal sensilla project to 205 unambiguously identified glomeruli in an antennal lobe, and all glomeruli belong to either of the antero-dorsal and the postero-ventral groups. We employed single sensillum staining techniques and investigated the topographic projection patterns of individual ORNs to elucidate the relationships between sensilla and glomeruli. We found that axons of ORNs in perforated basiconic sensilla project to the antero-dorsal group glomeruli and those in trichoid and grooved basiconic sensilla innervate the postero-ventral group glomeruli. To reveal the functional significances of these glomerular groups, we performed the optical recording using a voltage-sensitive dye (VSD). The VSD recodings detect the synchronized firing of local interneurons converging onto given glomeruli (See poster). The odorants processed by perforated and grooved basiconic sensilla evoked VSD signals at the antero-dorsal and the postero-ventral group glomeruli, respectively. It suggests these glomerular groups are functional compartmentalization. In addition, the distinct odorants induced the different temporal patterns of VSD signals. Taken together these results, odor identities are represented as spatio-temporal activity patterns of glomeruli.