

The Logic of Pheromone Detection: Visualizing the Organization and Development of a Sensory Map in the Mouse Accessory Olfactory Bulb.

Abstract

In mammals, the detection of pheromones is mediated by the vomeronasal system. In the main olfactory system, all olfactory sensory neurons that express a given olfactory receptor project to one or a few stereotyped glomeruli in the main olfactory bulb. In the vomeronasal system, vomeronasal sensory neurons (VSNs) expressing a given V1R receptor project to 10-30 glomeruli in the accessory olfactory bulb (AOB). We have generated several novel BAC (bacterial artificial chromosome) transgenic mice that specifically coexpress different fluorescent fusion proteins with different V1R pheromone receptors. We visualized the projections to the AOB of five sets of VSNs expressing five different V1R receptors from three different subfamilies. Neurons expressing a specific receptor project to multiple glomeruli that reside within several conserved, spatially restricted domains in the AOB. Furthermore, neurons expressing different receptors that are in the same receptor subfamily project to glomeruli in the same or similar domains. These findings support the idea of the domain as a functional unit that integrates information from different receptors. We also examined the role of sensory activity in the survival of VSNs and the development of the glomerular map. VSNs that are unable to respond to sensory stimuli die off preferentially. If activity is restored in a subset of VSNs, they are rescued from cell death; furthermore, their representation in the AOB is expanded. We conclude that activity competition may play a role in the development of glomerular domains in the AOB.