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Sommario	The sense of smell enables animals to detect myriads of different odors carrying information about the quality of food, the presence of pathogens, prey, predators, or potential mates. Olfactory sensory neurons (OSNs) in the nasal cavity are the interface of the main olfactory system with the external environment. The binding of an odorant molecule to specific olfactory receptors (OR) located in the cilia of these neurons triggers a transduction cascade that transduces the chemical signal into action potentials which travel along the axon of the OSNs to the olfactory bulb. Here, the odor information is processed and conveyed to higher brain centers, ultimately leading to the perception of smell. In this Thesis I studied the effect of two genetic manipulations on the firing activity of the OSNs: the ectopic overexpression of the inward rectifier potassium channel Kir2.1 and the deletion of the TMEM16b/Ano2 gene, that codes for the Ca2+- activated chloride channel TMEM16B. The overexpression of Kir2.1 reduces the excitability of the neurons, and when expressed in OSNs, mice show a general disorganization of the glomerular map in the olfactory bulb. Since spontaneous and sensory-evoked electrical activity play important roles in the formation of several sensory circuits, including the olfactory system,

	in the first part of this Thesis, I investigated how the spiking activity of mouse OSNs is influenced by the Kir2.1 overexpression, using loose-patch recordings from the OSNs knobs. I found that the overexpression of Kir2.1 caused a decrease in the spontaneous firing activity of OSNs but did not influence the evoked firing properties induced by odorant stimulation, indicating that the olfactory bulb disorganization was caused by a reduced spontaneous firing activity. Ca2+-activated Cl^- current (CaCC) is an important component of the transduction current evoked by odor stimulation in OSNs. Binding of odorants to their specific receptor on the cilia of OSNs causes the activation of adenylyl cyclase with a relative increase of intracellular cAMP, activating cyclic nucleotide-gated (CNG) channels. Ca2+ entry through CNG channels increases the open probability of Ca2+-activated Cl- channels. The molecular identity of these channels has been elusive for a long time, but recently it has been shown that the olfactory CaCC are mediated by the membrane protein TMEM16B/Anoctamin2. However, the physiological role of olfactory CaCC is still unclear, and the first description of TMEM16B knockout (KO) mice reported no clear olfactory deficits. In the second part of this Thesis, I studied basal firing properties and stimulus-evoked responses with loose-patch recordings in OSNs from TMEM16B KO or WT mice. OSNs responded to a stimulus with a transient burst of action potentials. Responses of OSNs from TMEM16B KO mice showed an increased number of action potentials compared to responses from WT mice, both in OSNs expressing a random or I7 OR. The basal spiking activity of individual OSNs is correlated with the expressed OR that drives basal transduction activity. I measured a reduced basal activity in TMEM16B KO OSNs expressing the I7 OR compared to WT OSNs. Moreover, axonal targeting was altered and TMEM16B KO had supernumerary I7 glomeruli compared to WT. These results show that the expression of TMEM16B affects OSNs firing properties and contributes to the glomerular formation and refinement of I7-expressing OSNs in the olfactory bulb, suggesting a crucial role for TMEM16B in normal olfaction.
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