Olfactory Research Using Genetically-engineered Mouse and Organoids

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Olfactory disturbance can develop at varying steps along the olfactory pathway, from the odorant receptors on olfactory neuronal cells to the olfactory cortex in the brain. Mouse models have been widely utilized for olfactory research, offering an accurate assessment of olfactory function that is crucial. Mutations in the G protein-coupled prokineticin 2 (PROK2) are known to cause Kallmann syndrome and idiopathic hypogonadotropic hypogonadism manifesting with delayed puberty and infertility. Based on published literatures, PROK2$^{-/-}$ mice showed marked reduction in the olfactory bulb (OB) size, loss of normal OB architecture, and accumulation of neuronal progenitors in the rostral migratory stream. In this study, we investigated the olfactory phenotype of mice lacking PROK2. For phenotyping analysis of mice lacking PROK2, we studied olfactory behavior test which has been developed through our previous published data to be effective assessment by an automatic video tracking system, functional MRI, and histopathology of olfactory epithelium and OB using H&E staining (hematoxylin and eosin staining), Nissl staining and IHC (immunohistochemistry) with antibodies of olfaction-related proteins. PROK2$^{-/-}$ mice had loss of response to favorite or hateful odorant compared with other genotype of littermate by olfactory behavior test. In addition, PROK2$^{-/-}$ mice showed abnormal olfactory epithelium architecture as well as OB hypoplasia. Our current findings might inform the development of novel approaches to comprehend the mechanism of olfaction and the relationship with olfactory function and olfactory structures.