Abstract

Olfaction serves essential functions in various behaviors such as foraging, predator evasion and intra-species communications especially in animals. Most vertebrates have a specialized olfactory system to detect and discriminate a multitude of different odorants. The first stage of olfactory information processing is initiated by several families of G protein-coupled receptors, which bind to odorants and pheromones. For odorant receptors of mice and fish it has been shown that individual receptor genes are expressed in spatially restricted zones, possibly to facilitate the wiring of the olfactory system during development. For the V1R-related *ora* receptor gene family the spatial patterning is not known so far. This receptor gene family arose early in vertebrate evolution and consists of six highly conserved genes.

In this work, the expression of the V1R-related *ora* receptor gene family was investigated in olfactory epithelia of adult zebrafish using *in situ* hybridization. The position of each labeled cell was quantified in three dimensions, radial distance from the center of the lamella, laminar height within the lamella, and height within the organ. The results show that every receptor gene exhibited a specific spatial expression pattern. Although some genes show very similar distributions with respect to radius as well as laminar height distribution and all genes were very similar with respect to height within the organ, expression patterns were significantly different between all genes for at least one of the three parameters analysed. Moreover, the results indicate that the height distribution of these receptor genes may be regulated by processes different from those regulating radial position.

Furthermore, in the clawed frog, the expression pattern of two trace amine-associated receptors TAAR4a and TAAR4b was determined and compared to the distribution of amine responses in the olfactory epithelium. High overlap of molecular and physiological distributions suggests that both TAAR4a and TAAR4b may be amine receptors. However, the amine response area is larger than Taar4a and Taar4b expression zones together, suggesting the existence of additional, as yet unidentified amine receptors in amphibian olfaction.

Moreover, the shape and spatial pattern of Go-immunoreactive cells in the olfactory epithelium of zebrafish was analysed. These cells constitute a new neuronal population in addition to three known types of olfactory sensory neuron, and were christened *kappe* neuron for their characteristic shape.