

Actin microfilaments in the submembrane zone of olfactory receptor cells as a potential factor in the regulation of their sensitivity

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Motivation and Aim: It is known that olfactory sensitivity to odorants correlates with area, width of sensory epithelium, quantity and maturity of the olfactory sensory neurons (OSNs) which has specific receptors with signal transduction system [1]. Previously, we have found that when the immature OSNs makes contact with its environment, the dendritic terminal develops a wide actin layer, inside which a pore is formed. It is assumed that the functional receptors of odorants generate across this pore the first intracellular signal from environmental water-soluble odorants [2]. According to our ideas, the wide layer of actin microfilaments serves as barrier for biochemical signals transduction inside the cell. We assume that actin microfilament polymerisation/depolymerisation in submembrane layer of dendrite terminal may be characteristic both for immature OSNs, and mature OSNs. It may provide sensitivity regulation to different odorant concentrations. Namely, in the absence of odorants, grade of actin polymerisation should be minimal, but in the excess of odorant concentration, amount of polymerised actin increased.

Methods and Algorithms: It was studied the peculiarities of actin microfilament development in the mature OSNs dendrite terminales of Baikalian fishes *Cottocomephorus inermis* (Jakowlew, 1890), *Cottocomephorus grewingkii* (Dybowski, 1874), *Comephorus baicalensis* Pallas, 1776 (Cottidae) and Wistar rats. Olfactory organs were fixed in paraformaldehyde, permeabilized in Triton-X100, stained with Phalloidin-FITC, and analysed on LSM 710 laser confocal microscope (Zeiss Germany).

Results: It was revealed that in all analyzed animals the observed actin-belt network consists of two types of regularly arranged meshes of different diameters: small meshes related to receptor cells and large meshes related to the apexes of supporting cells. Moreover the submembrane actin layer in the apical part mature OSNs has different grade of polymerisation. It is possible this reflects different level of their functional state which depends on specificity and mode of odorant action.

Conclusion: Our studies indirectly shows that regulation of sensitivity to odorants may be realised both biochemical signal transduction level, and by structural rearrangements of actin cytoskeleton of submembrane area of dendrite terminal. Thus the process of actin polymerization/polymerization in the apical part of receptor cells may be involved in primary process of chemoreception of OSNs by supporting the adequate level of their stimulation during the variable modes of exposure to odorants.

References

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