Mechanisms of proton negative feedback of H3 type horizontal cells in fish retina

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Centre-surround receptive field and colour signalling in lower vertebrates have been believed to be mediated by GABAergic feedback from horizontal cells (HCs) to cones, not being suppressed by picrotoxin. Proton released by HC depolarization was instead proposed (Hirasawa & Kaneko, 2003). H3 HCs of light-adapted goldfish retinae were intracellularly recorded with 10 mM HEPES. It suppressed depolarising response components to middle wavelengths, enhanced hyperpolarising blue responses, and suppressed hyperpolarising red responses. The HEPES dependent components resembled the inverse of H2 HC responses. These results indicate that HEPES suppressed feedback signals from H2 HCs to blue cones. Polarity inversion sometimes observed in red response indicates that the feedback to blue cones via H2 HCs was weaker to HEPES than the one directly from H1 HCs. Enhancement of blue responses by red background suggests that an influence on blue cone synaptic cleft-pH from H1 HCs could be greater than that from H2 HCs. These results suggest that proton negative feedback mechanism contributes to the chromatic photoresponses in H3 HCs, and that HEPES and chromatic adaptation much more suppressed feedback synapses through H2 HCs than those through H1 HCs.