A proton-mediated negative feedback effect on response dynamics of H1 and H2 horizontal cells

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Negative feedback signals from horizontal cells (HCs) to cones contribute to the formation of centre-surround antagonistic receptive field and colour signal transformation. Proton has been proposed as a negative feedback mediator released from HCs to cones (Hirasawa & Kaneko, 2003). 10 mM HEPES were applied to analyze the effects on the proton mediated feedback of H1 and H2 HCs. Responses to light stimulation of 5 different wavelengths with equal quanta were intracellularly recorded from HCs in light adapted carp or goldfish retina. HEPES depolarized dark membrane potential of HCs, increased light response amplitude of H1 HCs, and increased hyperpolarizing responses of H2 HCs while decreased red depolarizing responses. These effects are suggested to be attributed to suppression of proton mediated feedback from HCs to cones. We also observed a kink on response waveform at about 20 ms after response initiation in H1 HCs to red light, which was suppressed by HEPES. Similar kinks were also observed in H2 HCs to middle wavelengths, suppressed by HEPES. These results suggest that the kinks observed in H1 and H2 HCs are due to proton negative feedback signals from HCs to cones with a negative feedback synaptic delay of about 20 ms.