L- and M-cone input to human ERGs as a function of retinal eccentricity.

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Physiological studies have led to conflicting views regarding the nature of L- and M-cone input to ganglion cell receptive fields in the central compared to the peripheral retina. Some provide evidence in favour of a cone selective pattern of cone inputs, whilst others support a more random pattern of input. In order to investigate the nature of L- and M-cone input to ganglion cells we recorded ERGs from human subjects at temporal rates of 12Hz and 30Hz. These frequencies isolate the activity of cone-opponent and non-opponent post-receptoral mechanisms, respectively (Kremers and Link, 2008, Journal of Vision 8(15):11, 1–14). ERGs were obtained from these flickering stimuli with one of the following configurations: (1) Circular stimuli of different angular subtense which increased in 10^0 steps up to 70-deg diameter. (2) Annuli with 70-deg outer diameter but gradually ablated from the centre in 10^0 steps. L- and M-cone isolating responses were obtained from five colour normal subjects using a DTL fibre electrode. Cone contrasts were equalized for each stimulus condition.

Fourier analysis of the ERGs was used to measure the magnitude of the first harmonic of the response. The ratio of the L- and M-cone responses was found to be close to unity for 12Hz stimulation in both the central and peripheral retina. In addition, phase differences were close to 180^o. For 30Hz stimulation the L- and M-cone ratio was found to vary between 4:1 and 10:1 across observers, with smaller phase differences between the L- and M-cone responses.

These results suggest that for ERGs which reflect the activity of the L-M cone-opponent mechanism, a constant 1:1 input ratio exists between L- and M-cones as a function of retinal eccentricity. This result points to the maintenance of cone selective input in the peripheral human retina in chromatic vision.