Retinogeniculocortical Pathways: How Many?

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Given that all visual signals for conscious visual perception are transmitted to cortex via the lateral geniculate nucleus (LGN), it is important to understand how different aspects of visual stimuli reach the cortex in parallel. It is currently believed that aspects of a visual scene travel to the cortex by way of three functionally distinct channels that originate from different retinal ganglion cell (RGC) types. In this study, we conducted a morphological analysis of the RGC types that project to the LGN in the prosimian primate, bush baby (*Otolemur garnetti*).

LGN layers were identified by extracellularly recording visually evoked potentials. Either small (0.25ul) or large (1.5ul) injections of dextran-tetramethylrhodamine were injected into specific LGN layers to retrogradely label RGCs. After a 3-5 day survival the animals were deeply anesthetized, living retinas were then dissected, and ganglion cell morphology was revealed through photofilling (Dacey, 2003). Cellular structure was analyzed by confocal microscopy, digital photography and bioquant™ measurement. At least seven different RGC classes were found to project to the LGN in bush babies based upon each cell's: 1) soma diameter 2) dendritic field diameter and 3) organization and complexity of dendritic array.

In addition to verifying that midget and parasol ganglion cells project to the P and M layers, respectively (Yamada et. al., 1998), we found lambda-like and theta-like cells (as seen in cat retina; O'Brien et. al., 2002), large and giant sparse cells (as seen in macaque monkey retina; Dacey & Packer, 2003), and a 'fan' cell type not characterized previously. Given that there are more than three different RGC types that project to the LGN, it is likely that more than three visual pathways originate at the retina.

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