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Optical mapping of LGN receptive fields

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Adaptive optics tools in our lab have enabled us to simultaneously image the retina on a microscopic scale in real-time, track the eye motion, then target and optically stimulate individual retinal cells. Pychophysical experiments on humans using our system have confirmed that the receptive fields (the effective retinal sampling element) is almost certainly comprised of a single cone at the foveal center, but quickly departs from that away from the line of sight, even within the central one degree (Rossi & Roorda, 2010). To better quantify receptive fields near the fovea, we have used our system to image and stimulate individual cones in a monkey while recording neural activity in the lateral geniculate nucleus. Early experiments demonstrated how individual cone contributions to the receptive field can indeed be mapped. We also found that receptive fields are not uniform and symmetrical, but rather show variable responses from different cones (Sincich, Zhang, Tiruveedhula, Horton, & Roorda, 2009). Efforts are now underway to develop a system dedicated for stimulus delivery in the monkey that will not only enable efficient mapping of the cone contributions to the receptive field, but will also be able to determine their spectral subtypes.

Rossi, E. A. & Roorda, A. (2010). The relationship between visual resolution and cone spacing in the human fovea. Nat.Neurosci., 13, 156-157.
Sincich, L. C., Zhang, Y., Tiruveedhula, P., Horton, J. C., & Roorda, A. (2009). Resolving single cone inputs to visual receptive fields. Nat.Neurosci., 12, 967-969.