Selectivity without functional architecture in visual cortex of a highly visual mammal

Heimel JA, Van Hooser SD*, Chung S*, Nelson SB*, Toth LJ**
Netherlands Ophthalmic Research Institute, Amsterdam, *Brandeis University, Waltham MA, USA, **Boston University, Boston MA, USA

In mammalian neocortex, the orderly arrangement of columns of neurons is thought to be a fundamental organizing principle. In primary visual cortex (V1), neurons respond preferentially to bars of a particular orientation, and in many mammals these orientation-selective cells are arranged in a semi-regular, smoothly varying map across the cortical surface. Curiously, orientation maps have not been found in rodents or lagomorphs. To explore whether this lack of organization in previously studied rodents could be due to low visual acuity, poorly differentiated visual brain areas, or small absolute V1 size, we examined V1 organization of a larger, highly visual rodent, the gray squirrel. Using intrinsic signal optical imaging and single cell recordings, we found no evidence of an orientation map, suggesting that formation of orientation maps depends on mechanisms not found in rodents. We did find robust orientation tuning of single cells, and this tuning was invariant to stimulus contrast. Therefore it seems unlikely that orientation maps are important for orientation tuning or contrast invariance in V1. We conclude that an orderly arrangement of functional receptive field properties is not a universal characteristic of cortical architecture.

J. Alexander Heimel, Netherlands Ophthalmic Research Institute, Meibergdreef 47, 1105 BA Amsterdam, t 020-5664539,

Poster: Neuroscience 2 on Thursday 3 June