the weekly principle(s): ‘overlay of egocentric maps’
THE MAPPING OF THE FIELD OF VIEW ONTO THE RETINA IS AN EXAMPLE OF A TOPOGRAPHIC REPRESENTATION: the left visual field light is represented (excites V1 neurons) in the right striate/V1 cortex (and vice versa) – the upper half of the visual field is represented in the bottom half of V1 (and vice versa) – light hitting the retina close to the fovea excites neurons in the central lateral region of V1 (light hitting the outer edge of the retina excites neurons in the central medial region of V1)
overlay of egocentric maps - the second map – ocular dominance

lateral geniculate projections to the visual cortex form ocular dominance columns corresponding to inputs from the left and right eye – visualized via cytochrome oxidase staining – dominance map is aligned to retinotopic map
orientation tuning in primary visual cortex
orientation tuning in primary visual cortex
How to build a simple cell

multiple LGN center-surround cells arranged in a line

Squire et al., 2003
overlay of egocentric maps - the third map – orientation tuning ‘pinwheels’

-V1 neurons respond preferentially to bar stimuli having certain orientations
- across V1, neurons responding to the same orientation are grouped
- groups of like-responding neurons are, in turn, organized in a repeating fashion around a central point forming ‘pinwheels’
pinwheel centers follow the contours of ocular dominance columns
overlay of egocentric maps - the fourth map - color

-LGN koniocellular layers project to striate cortex layers II,III

  in a ‘blob’-like fashion

- ‘blob’ neurons are color-sensitive

- ‘blob’ centers follow the contours of ocular dominance columns
putting the egocentric maps together –
retinotopy, ocular dominance, orientation preference, koniocellular layer II / III inputs (color info)

‘blob’ (koniocellular - color info)  ‘pinwheel’ (colors = orientation pref.)  L-eye  R-eye
‘what’ (temporal) and ‘where’ (parietal) pathways in monkey and human

- damage to IT (TE + TEO) impairs object identification (but only via visual information)

- damage to parietal cortex (MT, MST, 7a, VIP, LIP) impairs visuospatial abilities (e.g., reaching to an object)

Moving from V1 along the what pathway:

- progressive loss of retinotopy
- increasing receptive field sizes
- increasing generalization across stimulus features (e.g. size, shape, color, illumination)
category organization in IT cortex: an anatomical substrate to explain prosopagnosia?
along the ‘where’ pathway: area MST integrates optic and vestibular ‘flow’
area VIP of parietal cortex: bringing together personal spaces of the somatosensory and visual systems