

Visual System

Photoreceptors

Rods

- monochromatic
- low spatial resolution
- mostly in periphery of retina

Cones

- 3 types respond to light of different wavelengths (color)
- high spatial and temporal resolution
- concentrated in fovea

Fovea is most sensitive area of retina because

- high concentration of cones
- thinning of cell layers over fovea

Lateral inhibition in retina lead bipolar cells to exhibit on-center and off-center receptive fields

Photoreceptors -> bipolar cells -> ganglion cells -> LGN -> V1 Layer 4 (area 17)

Nasal ganglion cells -> contralateral LGN

Temporal ganglion cells -> ipsilateral LGN

LGN has 6 layers (4 parvocellular and 2 magnocellular) each with a retinotopic map

Inputs from the right and left eye are represented separately in ocular dominance columns in the visual cortex

Separate representations from each eye help perceive depth

Adjacent locations of layer 3 in V1 respond to similar orientation

The parvocellular pathway

- largely projects to the ventral stream

Blobs (largely project to V4)

- colors
- contrast (brightness)

Interblobs

- orientation
- location

The Magnocellular pathway

- largely projects to MT and the dorsal stream
- motion
- contrast (brightness)

The dorsal stream to the parietal cortex is largely involved in spatial perception (“where”)

The ventral stream to the inferior temporal cortex is largely involved in object recognition (“what”)

Subcortical projections from retina to superior colliculus permit subconscious recognition of objects

Theories of object recognition

Hierarchical (there is a cell to represent each worldly object)

Problems

- if a cell dies do you lose perception of its object?
- how do we perceive new objects (lots of objects in the world)?

Ensemble Coding of Objects

- Cells coding parts of an object fire synchronously to create perception

Visual agnosia is a deficit in object perception

Prosopagnosia is a deficit in face perception

Indicates face processing (and possibly other complex objects) is specialized in the brain