Vision
The Eye and the Visual Receptors

Stimulus which activates visual receptors: light waves in the visible spectrum

Light waves are a small range of wavelengths (~350-750 nanometers) of electromagnetic energy.

Transparent Cornea
- Curve of cornea helps to focus light waves on retina
- "Astigmatism" causes 2 focal points instead of 1

Green Muscular Iris & Black Pupil Hole
- Muscles of iris under ANS control
  - Symp: dilate pupil
  - Parasymp: constrict

Lens becomes less flexible later in life — need reading glasses
Looking Into Left Eye: Optic Disk or “Blind Spot” - axons exit eye to form optic nerve

You can locate your own blind spot with the demo on p. 156.

Center (Macula) of Retina Needed for Detail Vision (Fovea especially)

Macular Degeneration

Loss of the critical central region of retina
Smoking is #1 preventable cause

What you might see

Rods vs Cones

- ~120 million/eye
- more in periphery
- very sensitive (low threshold)
- ~100 rods share same optic nerve fiber to brain
- night vision (scotopic vision)

- ~6 million/eye
- most in center, especially in the fovea
- Need bright light to reach threshold (photopic vision)
- have more private lines to brain- good for detail vision or “acuity”
- color vision
Turning Light Waves Into Electrical Messages (Transduction)

- Rods & cones have molecules of light sensitive photopigment embedded in cell membrane.

- Rods – rhodopsin
- Cones – 1 of 3 iodopsins
  - Like metabotropic transmitter receptors, except they receive light!
  - But receiving light has a surprising effect

2 Theories of Color Vision Proposed in 1800’s
- Trichromatic Theory (“Component Theory”) – 3 different types of color receptors work together to represent all colors of the spectrum.
- Opponent Process Theory – cells in the visual pathway receive input about pairs of colors (R-G or B-Y). One color makes them fire faster, the other makes them fire slower.

Color “Opposites” on the Color Wheel
- “Afterimages” of strong visual stimuli appear in opposite colors

Cones
- 3 different types, absorbing different ranges of wavelengths
- Supports the Trichromatic theory

Visual Fields
- Each half of your brain sees the opposite half of your visual world
Many Regions of Cortex Involved in Visual Processing

- Primary visual cortex is just the first level of cortical processing
- Damage here → “cortical blindness”
- Secondary “visual cortex” has separate regions devoted to shape, color, location, & movement that extend beyond occipital lobe.

Visual Agnosia (not recognizing)

- Damage to different parts of this system lead to different kinds of visual agnosia (object agnosia, color agnosia, movement agnosia)
- Prosopagnosia - can’t recognize individual faces (or similar members of other complex classes of visual stimuli) – most often seen after damage to the inferior temporal lobe’s fusiform gyrus (in pink)

Visual Processing Cases

- Object Agnosia
  - http://www.youtube.com/watch?v=8eG8lOd3P4k&feature=related
- Object agnosia & trouble locating visual stimulus
  - http://www.youtube.com/watch?v=dG8JGg2d2Pk&feature=related
- Prosopagnosia (“face blindness”)
  - http://www.youtube.com/watch?v=8eG8lOd3P4k&feature=related
- Prosopagnosia (face blindness)
  - http://www.youtube.com/watch?v=dG8JGg2d2Pk&feature=related
- Motion blindness
  - http://www.youtube.com/watch?v=8eG8lOd3P4k&feature=related
- “Blindsight” https://www.youtube.com/watch?v=8eG8lOd3P4k&feature=related

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