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9.01 Introduction to Neuroscience
Fall 2007

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9.01 Recitation (R02)

RECITATION #4: Tuesday, October 16th

Review of Lecture: 9, 10

Reading: Chapter 9 and 10 of *Neuroscience: Exploring the Brain* (3rd edition)

Outline of Recitation:

- I. Questions on the Exam?
- II. Review of Material: **VISION**
 - a. **The Eye and Retina**
 - Structure of the eye
 - Anatomy of Retina
 - Phototransduction
 - Receptive Fields
 - Color Perception
 - Visual Pathway
- III. Practice Exam Questions

THE EYE AND THE RETINA:

Structure of the eye: (p283)

Diagram removed due to copyright restrictions.

- pupil: opening that allows light to enter the eye
- iris: surrounds pupil; pigmented
- sclera: "white of the eye"
- extraocular muscles: moves eyeball
- conjunctiva: membrane that covers extraocular muscles
- aqueous humor: nourishing fluid behind cornea
- lens: transparent; adjusts focus
- ciliary muscles: controls shape of lens
- zonule fibers: ligaments that suspend lens
- vitreous humor: lies between lens and retina; keeps eyeball spherical

View of the Retina (ophthalmoscope):

- optic disk: where optic nerve fibers exit retina and retinal blood vessels enter. No photo receptors (blind spot).
- macula: part of the retina for central vision; absence of blood vessels
- fovea: marks the center of retina

Photo removed due to copyright restrictions.

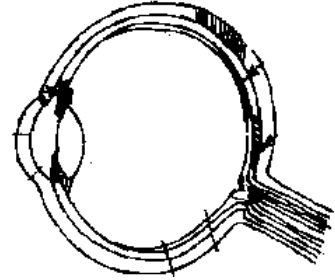
Focusing light onto the retina: (p283-288)

Refraction by cornea:

Accommodation by lens:

- Near point:
- Far point:

Pupillary light reflex:



Anatomy of retina: (p288-292)

Two important points:

- (1) *Photoreceptors* are the only light-sensitive cells in the retina.
- (2) *Ganglion cells* are the source of output from the retina to the brain via the optic nerve. Only cells fire AP.

Two different types of photoreceptors:

(1) *Rods:*

Found mainly in the:
*Outnumber cones 20:1

(2) *Cones:*

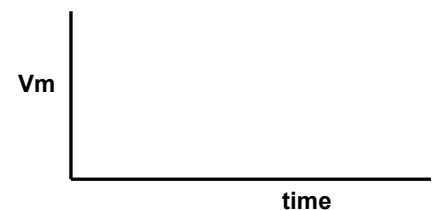
Found mainly in the:

Phototransduction: (p292-298)

Photoreceptors convert or transducer light energy into changes in membrane potential.

Dark: depolarize

Light: hyperpolarize w/ light stimulus
(only OFF response)



Receptive Fields and Retinal Processing: (p298-306)

Receptive Field:

- the region of visual space that, when stimulated, causes a retinal neuron to respond
- the region of a sensory surface (retina) that, when stimulated, changes the membrane potential of a neuron

- point-to-point mapping
- locality of receptive fields a result of structure of cells in retina...
 - short dendrites (doesn't spread across retina)
 - center-surround receptive fields

Bipolar Cell Receptive Fields:

ON bipolar cells:

OFF bipolar cells:

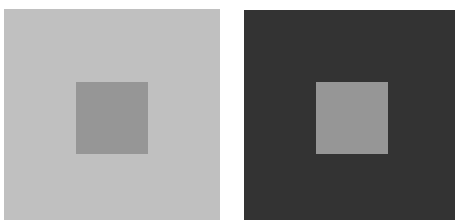
Center-surround receptive fields:

Ganglion Cell Receptive Fields:

- ON and OFF ganglion cells like bipolar cells
- Center-surround receptive fields

Ganglion cells are mainly responsive to *differences* in illumination that occur within their receptive fields.

- Light vs. reality (examples: illusions)
 - visual system detects reflection, not luminance
 - incident light x reflectance
 - based on context



Adaptation: (box 4.6)



