Homework6-2020

1. What is the evidence that color vision is trichromatic?

Researchers used suction electrode to detect single photoreceptor from rhesus monkey (a kind of Old-World Monkey) potential change after variant wavelength monochromic light stimulation, and discovered three types of photoreceptor with characteristic light absorption.

2. What observations led Kuffler to define two types of retinal ganglion cells, off-center and on-center? Explain how this receptive field organization is useful in detecting luminance contrast and changes in light intensity.

Kuffler detected single ganglion cell by using a small circular light to stimulate retina. Noticed that some of ganglion cells excited when the light stimulation is on the center of receptive field and inhibited when the light simulation is on the surrounding, whereas the other ganglion cells are opposite to them.

From theory of two types of RGC, we can speculate that RGC whose receptive field is fully covered by darkness or light contains similar firing rate whether it On-center or Off-center. But RGCs whose receptive field are located cross the edge of light and darkness will quite differ in their firing pattern. So, ganglion cell tends to be more sensitive to the luminance change between the edge, which constructs the fundament of detection of luminance contrast and changes in light intensity.

3. Why is light adaptation in the retina so important?

Light adaption gives us ability to detect objects in high luminance background.

4. What is the role of horizontal cells?

Horizontal cells receive input from photoreceptors and release GABA back to the presynaptic terminal of photoreceptor to regulate the release of glutamine. For different horizontal cells have gap connections, they can integrate inputs from photoreceptors and contribute to light adaption in the retina.

5. If your right visual cortex stopped functioning, what part of your visual field would be lost?

The left visual field. Because right visual cortex receives projections from nasal side of left eye and temporal side of right eye, both receive light simulation from left side.

6. Is the world mapped upside down on the retina? On V1?

The world is mapped upside down on the retina and on V1.

7. How do receptive field characteristics of neurons in V1 compare with those in the ganglion cells in retina?

(1) Receptive field characteristic of V1 is more integrative than those in RGCs.

(2) They mainly encode information of lines and edges.

(3) There are two types of cell called simple cell and complex cell in V1. The receptive field of simple cell is converged from a series of LGN cells; hence the receptive field of complex cell is converged from a series of simple cells.

8. What are ocular dominance columns and orientation columns?

**Ocular dominance columns** lay in visual cortical layer 4 and is perpendicular to the surface of brain, which preferentially respond to the input from one eye.

**Orientation columns** are lay in visual cortex and span multiple layers, which is perpendicular to the ocular dominance columns, which sensitive to characteristic orientation of light.

**Key Terms**

amacrine cell

arrestin

bipolar cell

ciliary muscle

cones

cyclic guanosine monophosphate

dichromacy

fovea

foveola

ganglion cell

horizontal cell

interphotoreceptor retinoid binding protein

IRBP

iris

lens

light adaptation

mesopic vision

off-center ganglion cell

on-center ganglion cell

opsin

optic disc

optic nerve

pigment epithelium

photopic vision

photoreceptor

phototransduction

retina

retinal

retinal pigment epithelium

rhodopsin

rhodopsin kinase

rods

scotopic vision

transducin

trichromatic

binocular field

dorsal lateral geniculate nucleus

middle temporal area (MT)

nasal division

occular dominance column

optic chiasm

optic nerve

optic radiation

optic tract

pretectum

primary visual cortex (V1)

primary visual pathway

superior colliculus

V4

visual field