

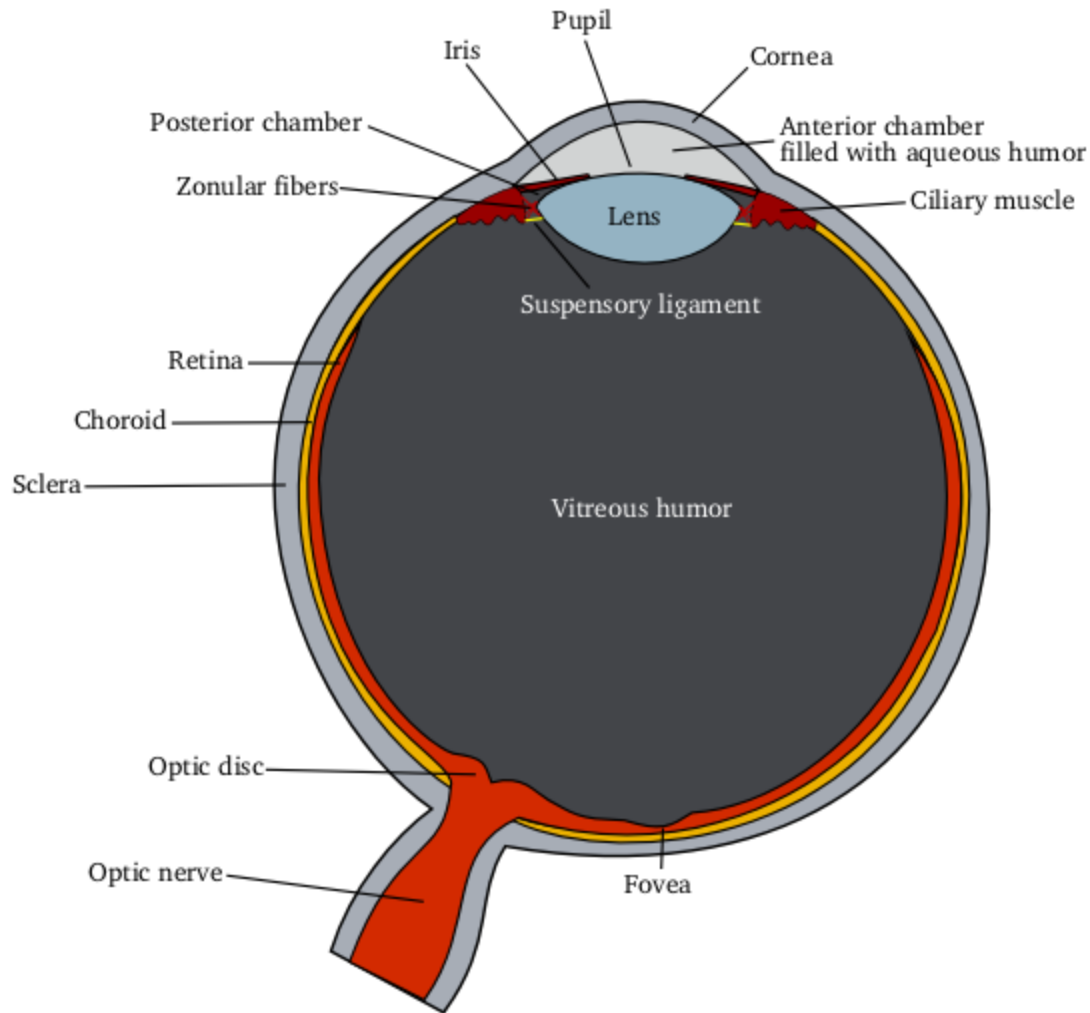
The Retina

How it works and how
astronomers can take advantage
of its structure and function

Brief outline

- Discuss the structure and function of the retina, focusing on the answer to three questions:
 - What is dark adaptation?
 - Why do we use red flashlights?
 - How and why does averted vision work?

Basic structure of the eye



http://en.wikipedia.org/wiki/Image:Schematic_diagram_of_the_human_eye.png

Photoreceptors – Rods and Cones

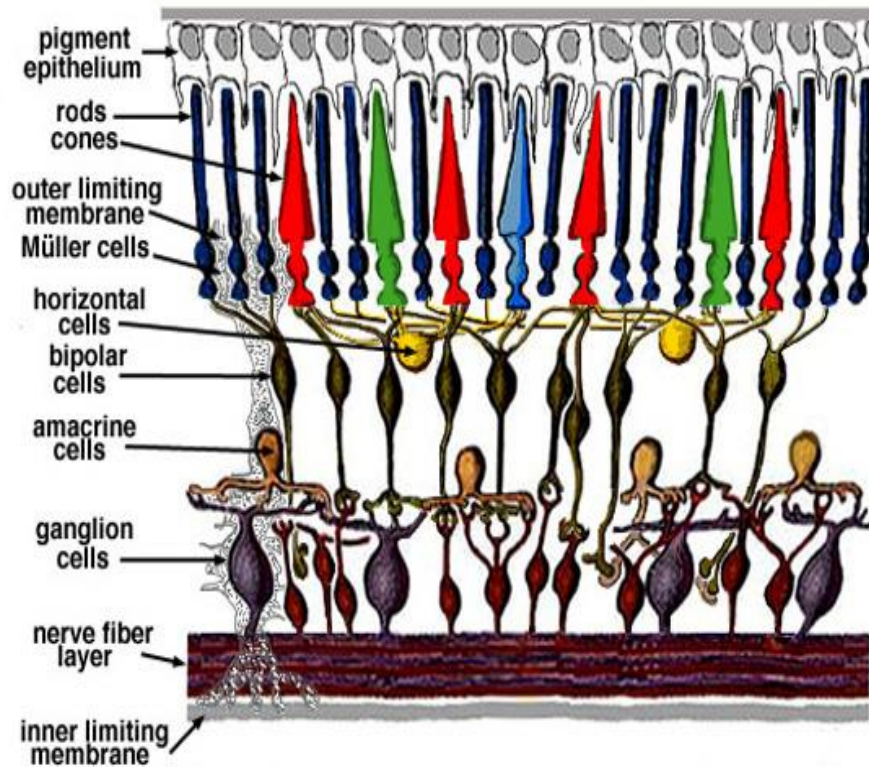


Fig. 2. Simple diagram of the organization of the retina.

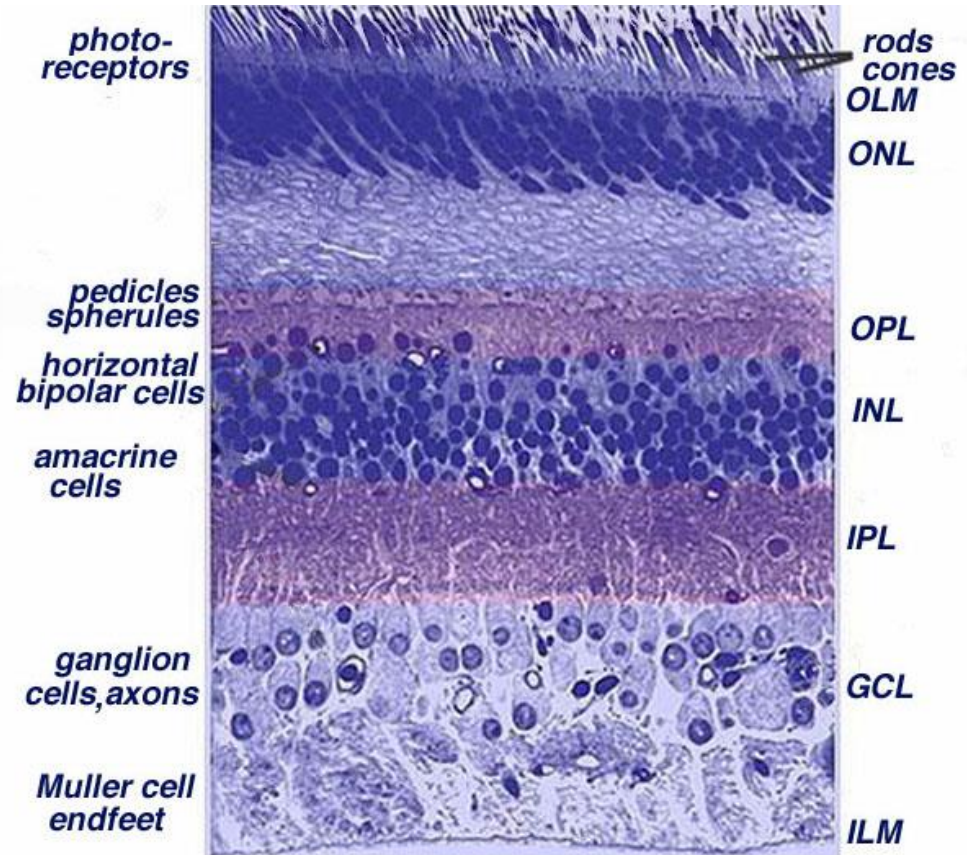
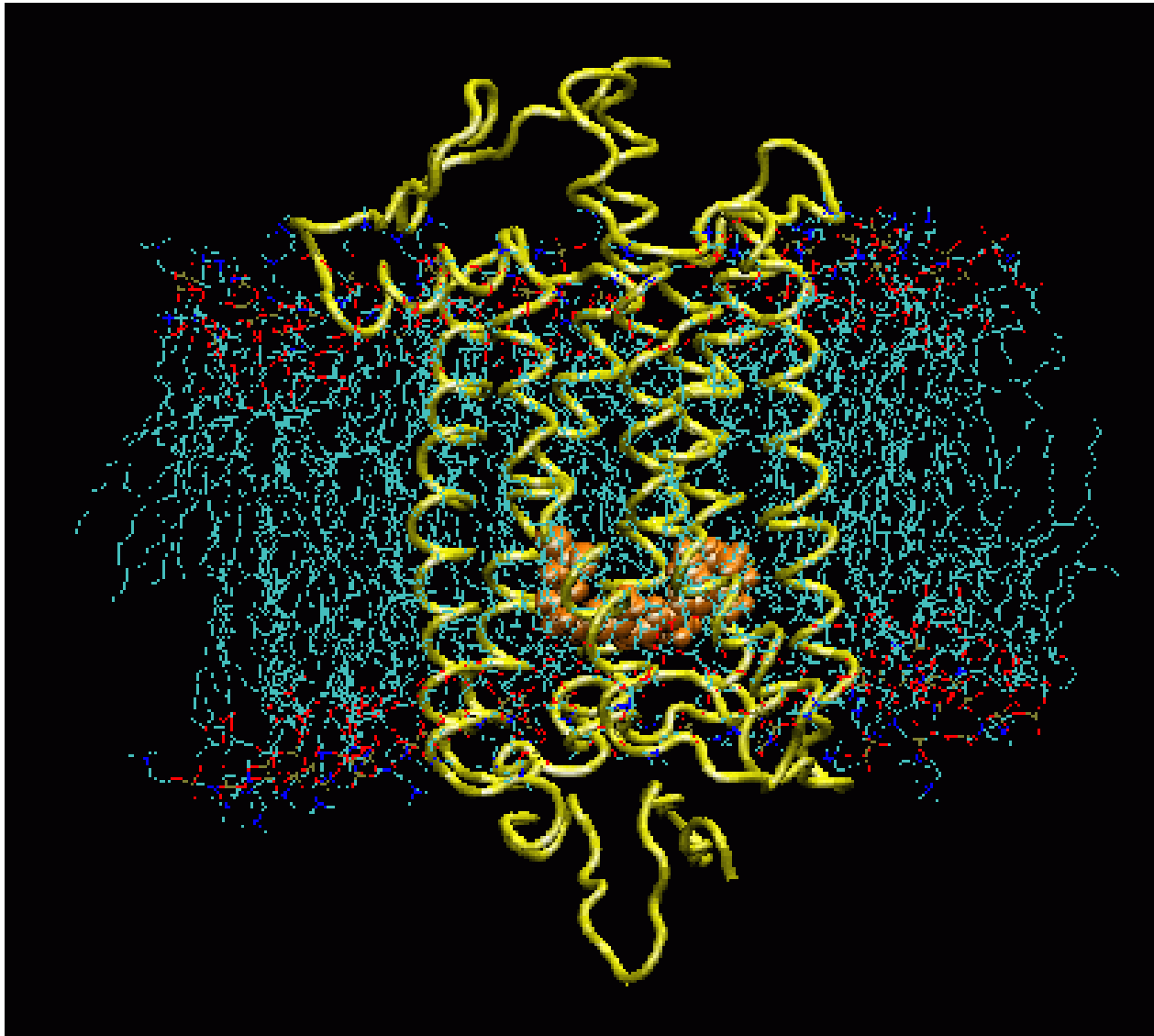


Fig. 3. Light micrograph of a vertical section through central human retina.

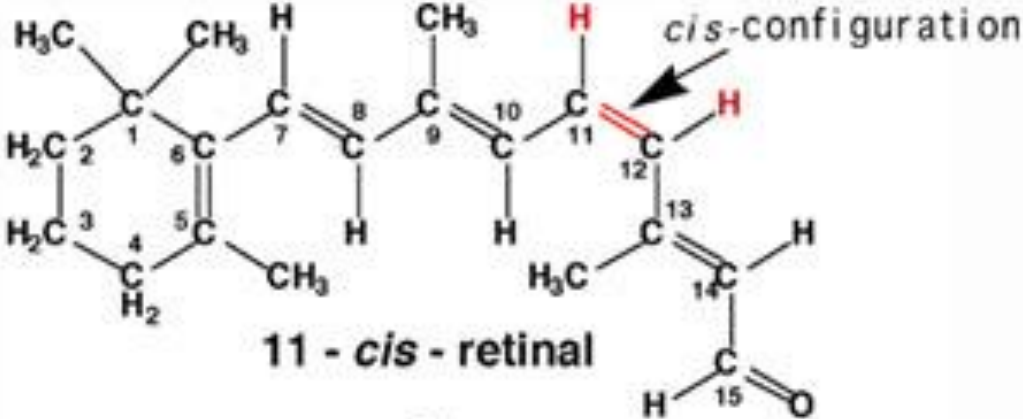
Diagrams taken from: <http://webvision.med.utah.edu/sretina.html>

Rhodopsin – the light-detecting molecule in rods




<http://www.ks.uiuc.edu/Research/rhodopsin/>

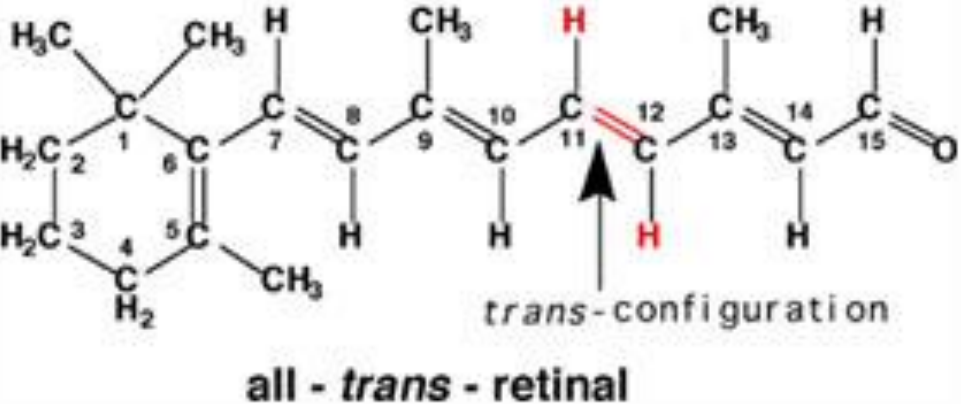
Retinal isomerization – phototransduction in action



Visible light



A large black arrow pointing downwards, indicating the transition from the 11-cis form to the all-trans form upon absorption of visible light.



What is dark adaptation?

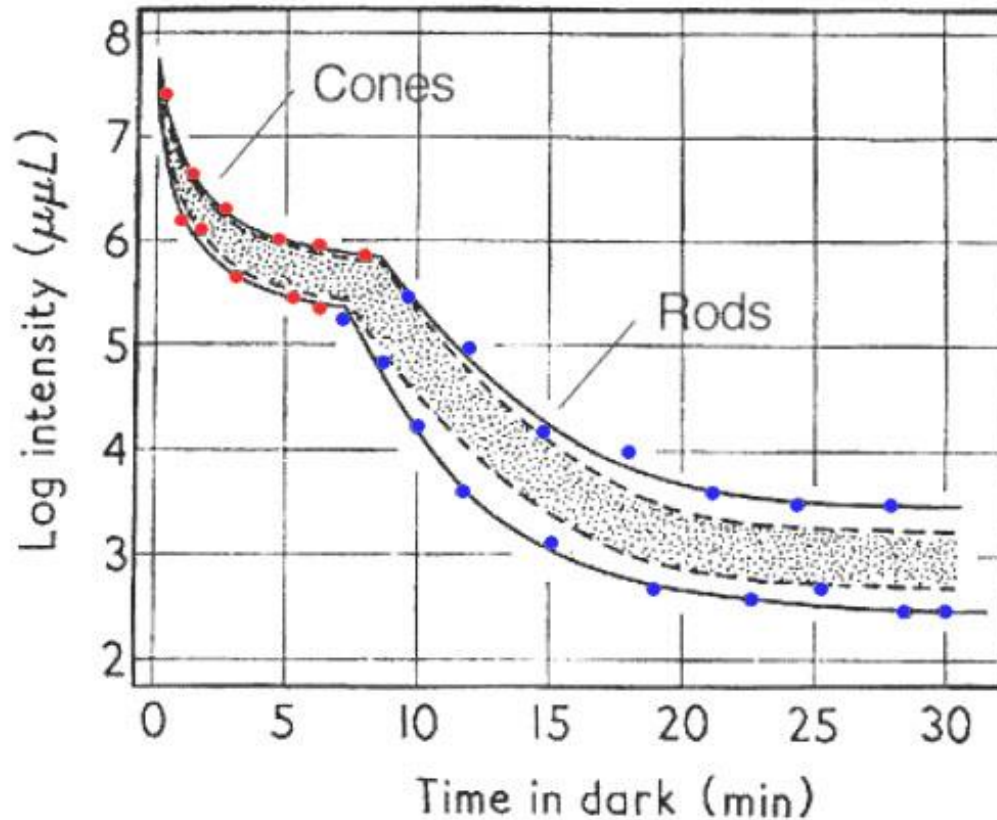


Figure 1. Dark adaptation curve. The shaded area represents 80% of the group of subjects. Hecht and Mandelbaum's data from From Pirenne M. H., *Dark Adaptation and Night Vision*. Chapter 5. In: Davson, H. (ed), *The Eye*, vol 2. London, Academic Press, 1962.

Why do we use red flashlights?

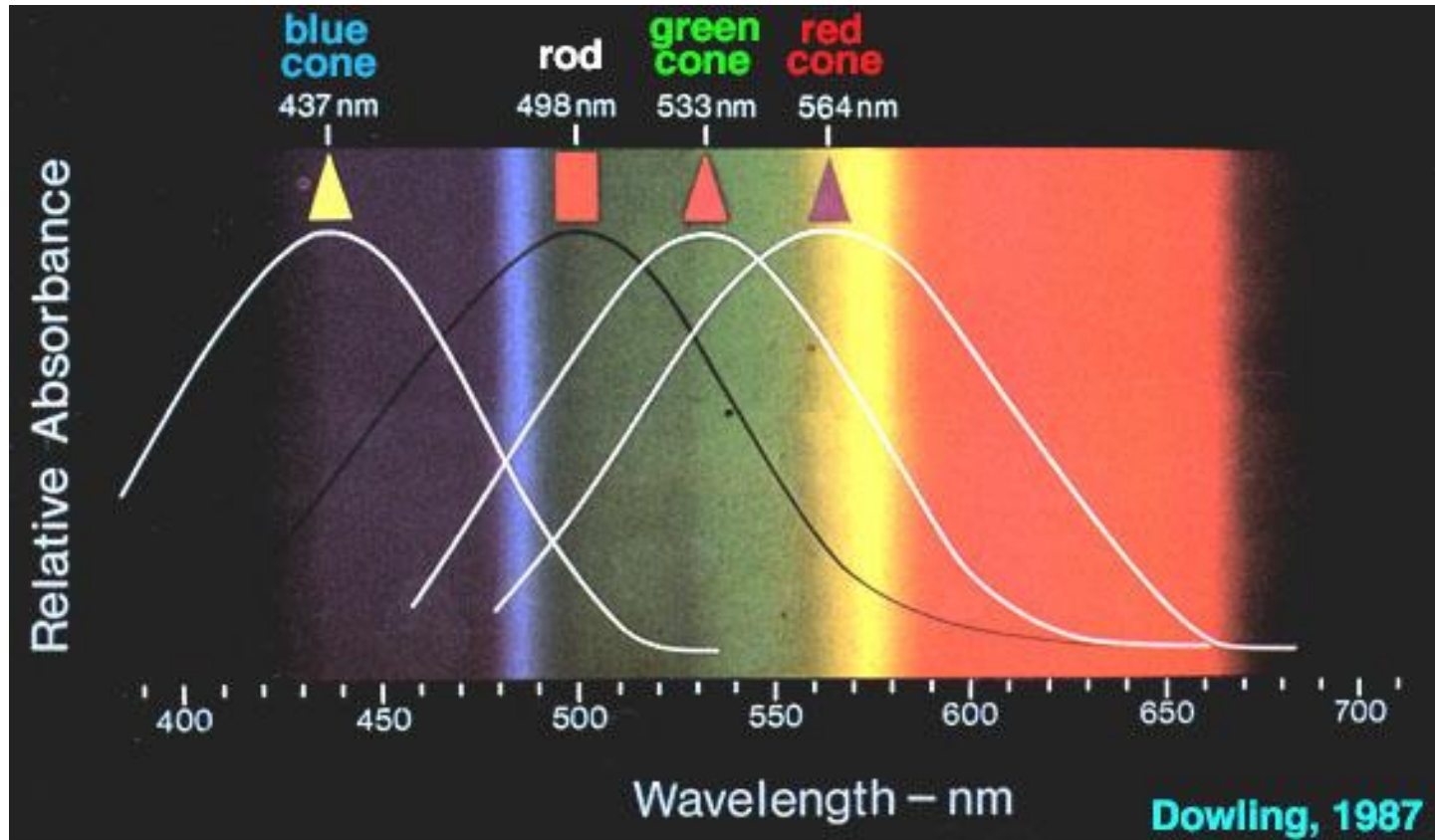


Fig. 14. The peak spectral sensitivities of the the 3 cone types and the the rods in the primate retina (Brown and Wald, 1963). From Dowling's book (1987).

<http://webvision.med.utah.edu/imageswv/spectra.jpeg>

How does averted vision work?

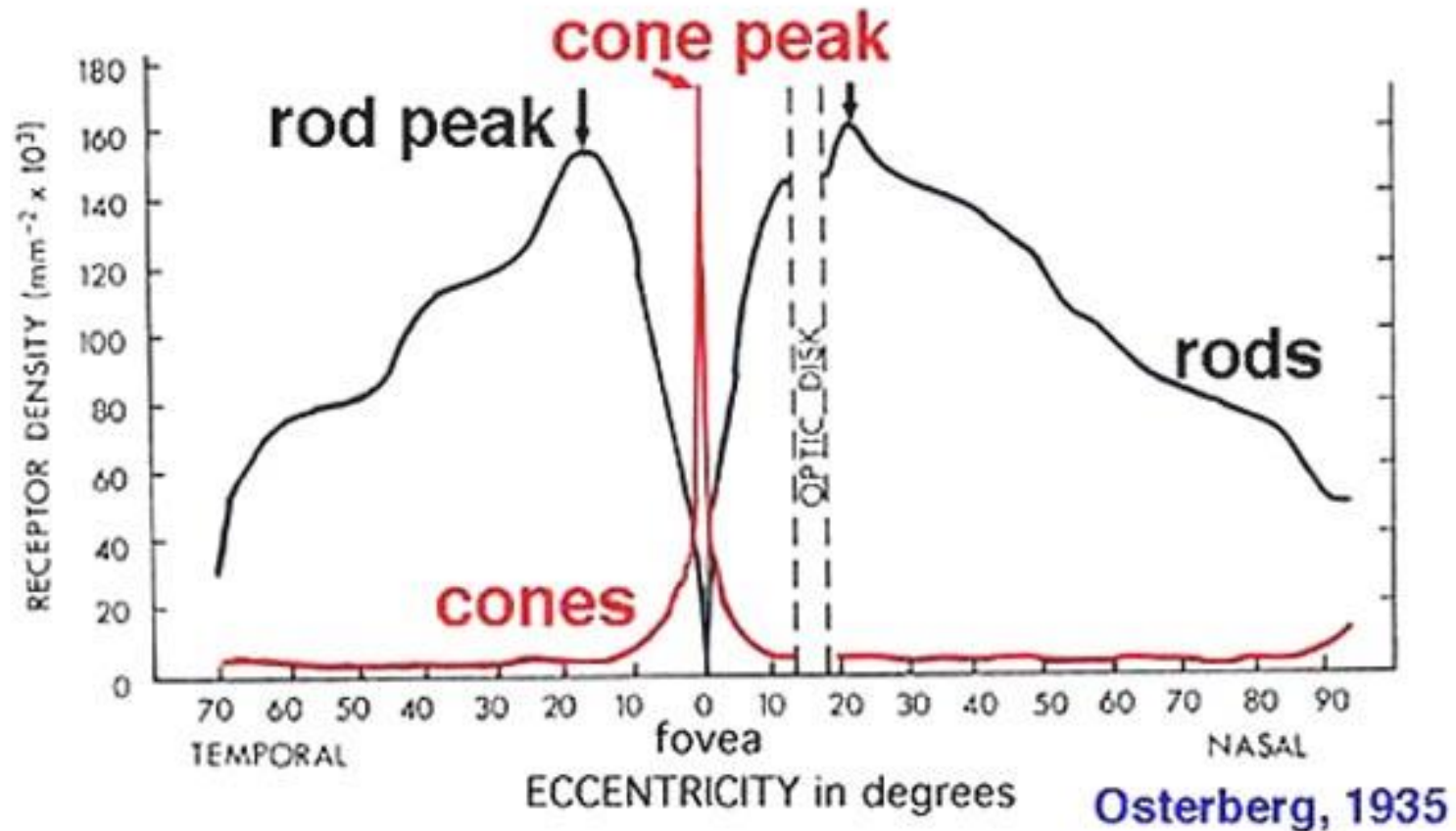


Fig. 20. Graph to show rod and cone densities along the horizontal meridian.

<http://webvision.med.utah.edu/imageswv/Ostergr.jpeg>

Homework

- Is averted vision equally effective regardless of the direction to which you avert your eyes?
- If not, in which direction should you look (up, down, left or right of the subject) for averted vision to be most effective?
- Why would averted vision be more effective in one direction than others?
- How far must you avert your eyes for maximal effectiveness?
- What do these results tell you about the structure of the retina?