PHY238Y
Lecture 26

- **Resolving power of the human eye**
- **Quantum nature of vision**
  - **Structure and physiology of retina**
  - **Molecular mechanism of vision**

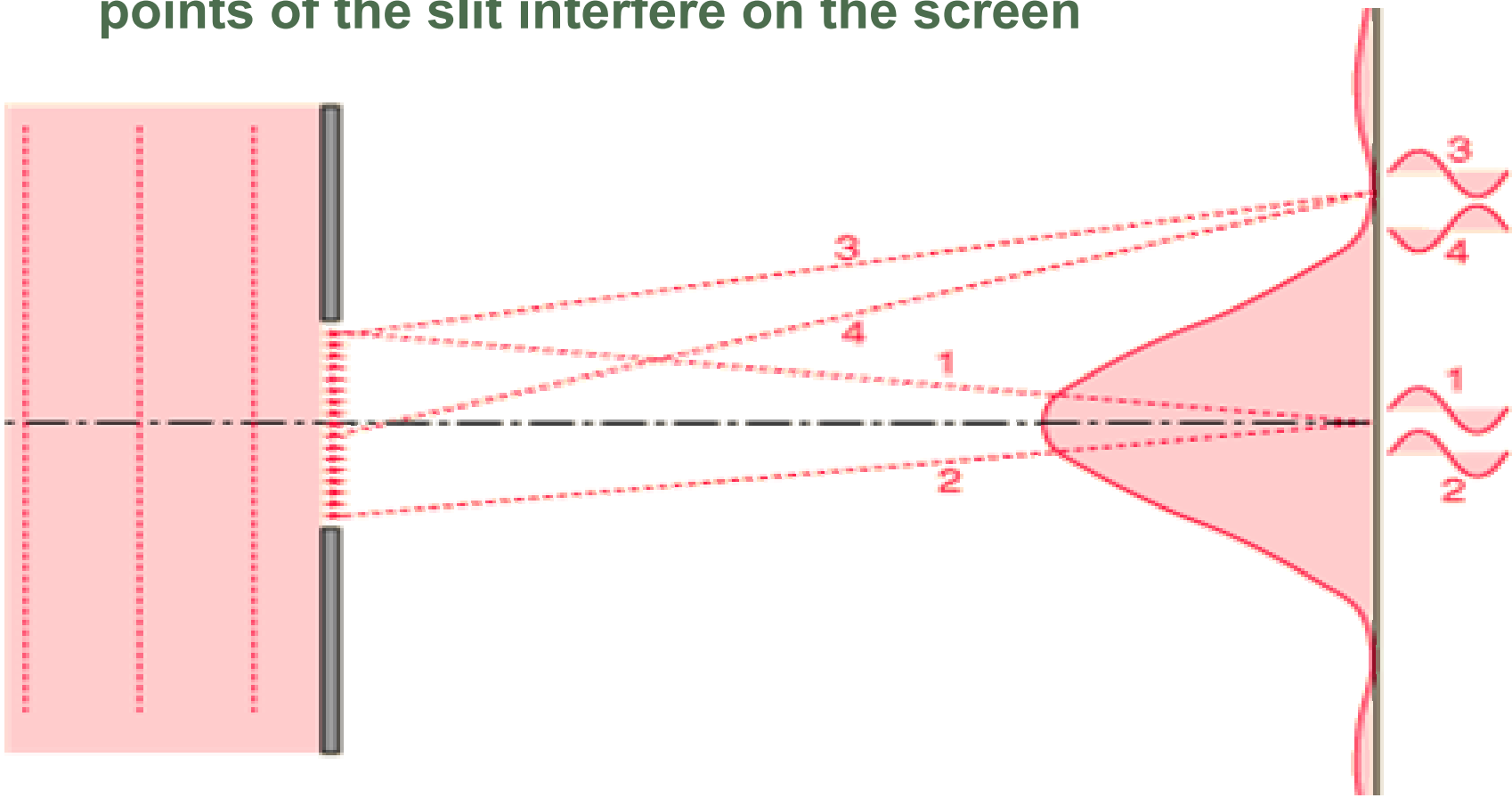
References:

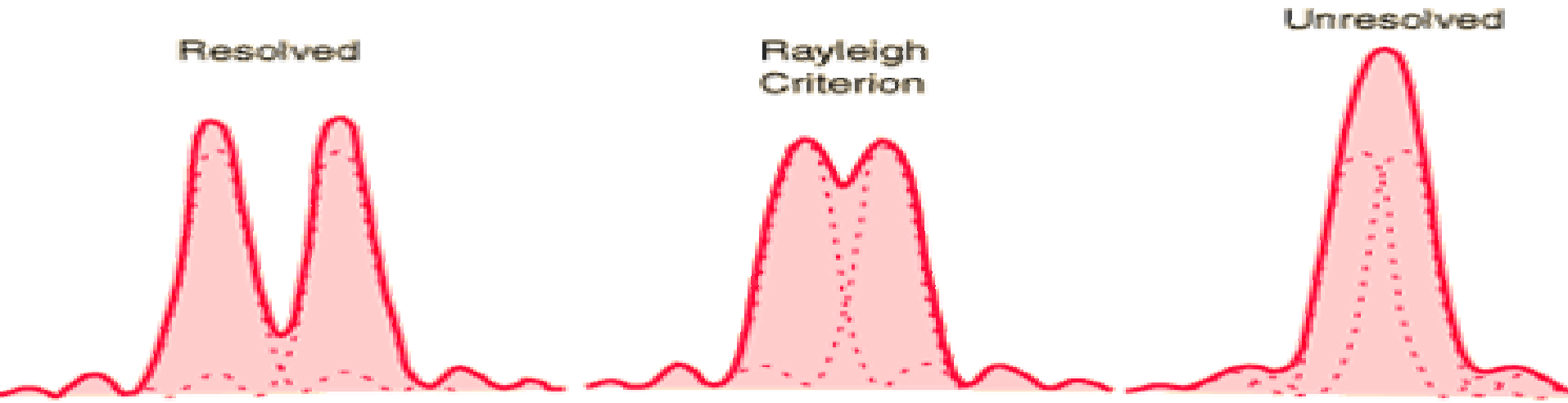
Hallett et al.: Physics for the life sciences, 4th ed., 2003, Ch. 5

Hyper Physics: http://hyperphysics.phy-astr.gsu.edu

Thanks to dr. Rod Nave for the permission to use some of the pictures

- Single–slit diffraction experiment: waves from different points of the slit interfere on the screen





Diffraction through a pinhole: Rayleigh's criterion of resolving the image

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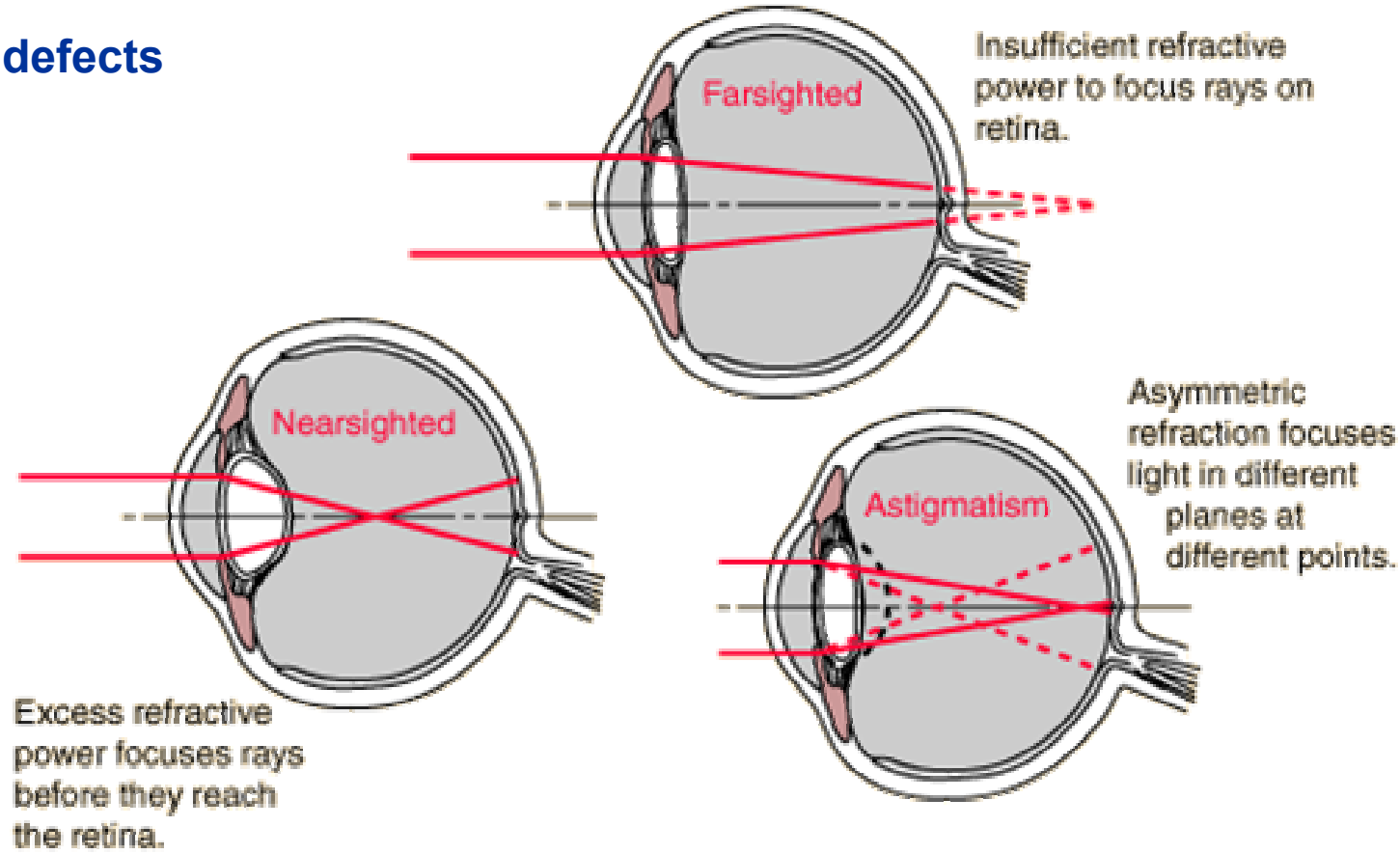
- **Vision defects**



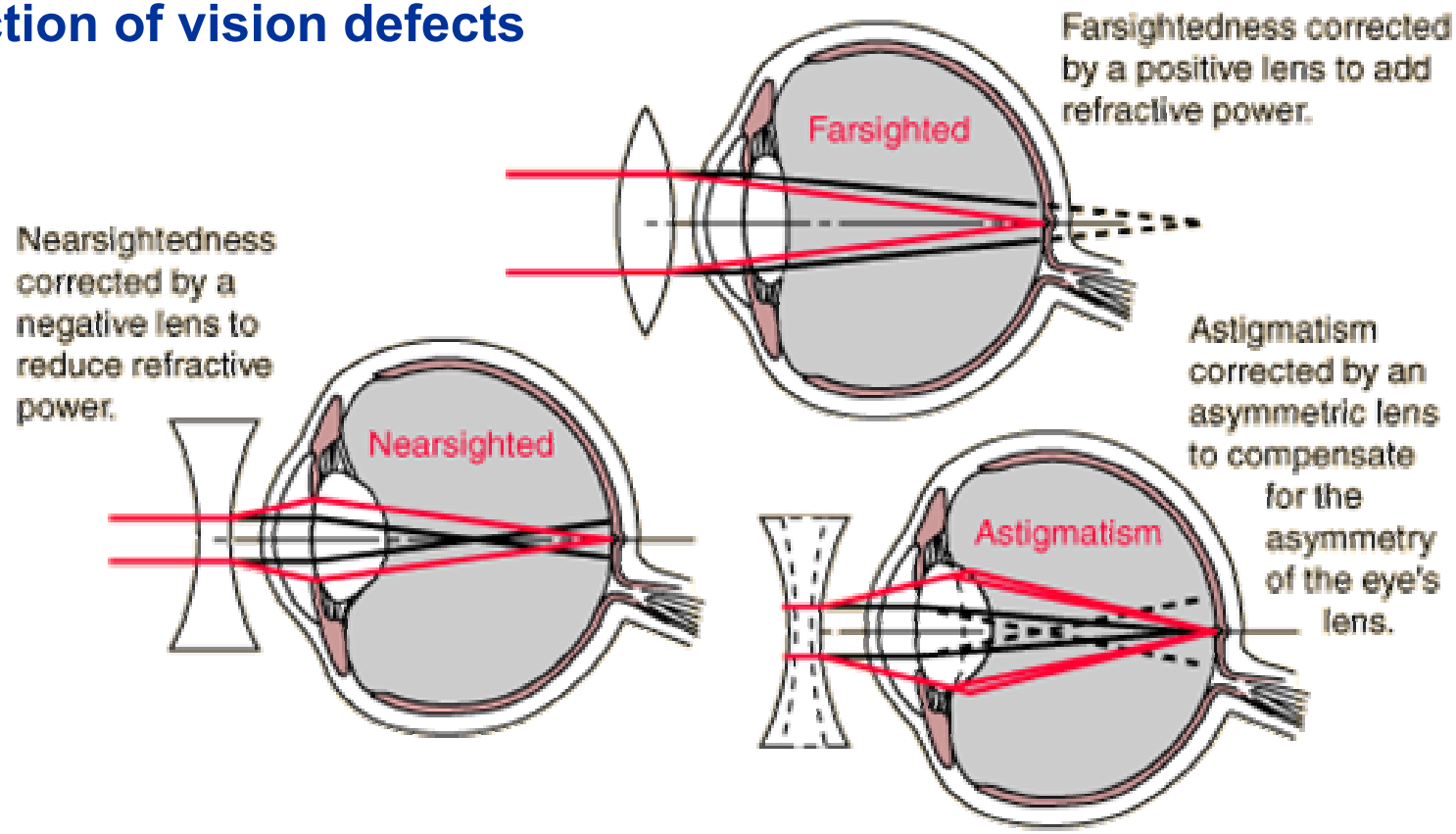
Lecture 25

- The Snellen Chart (the vision check): the normal eye can resolve details that subtend 1 minute of arc only!

- On-line eye test:

www.mdsupport.org/eyetests.html

- **Correction of vision defects**



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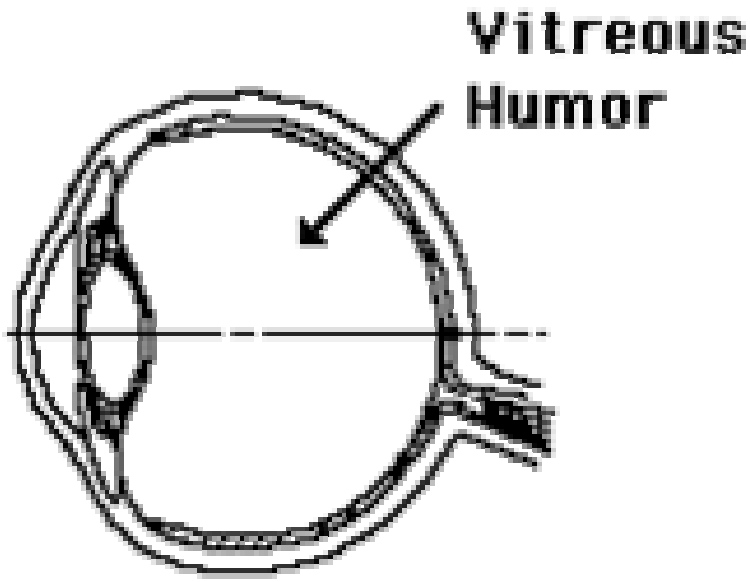
- The larger chamber of the eye is filled with the gelatinous "vitreous humor", which has an index of refraction of about 1.337



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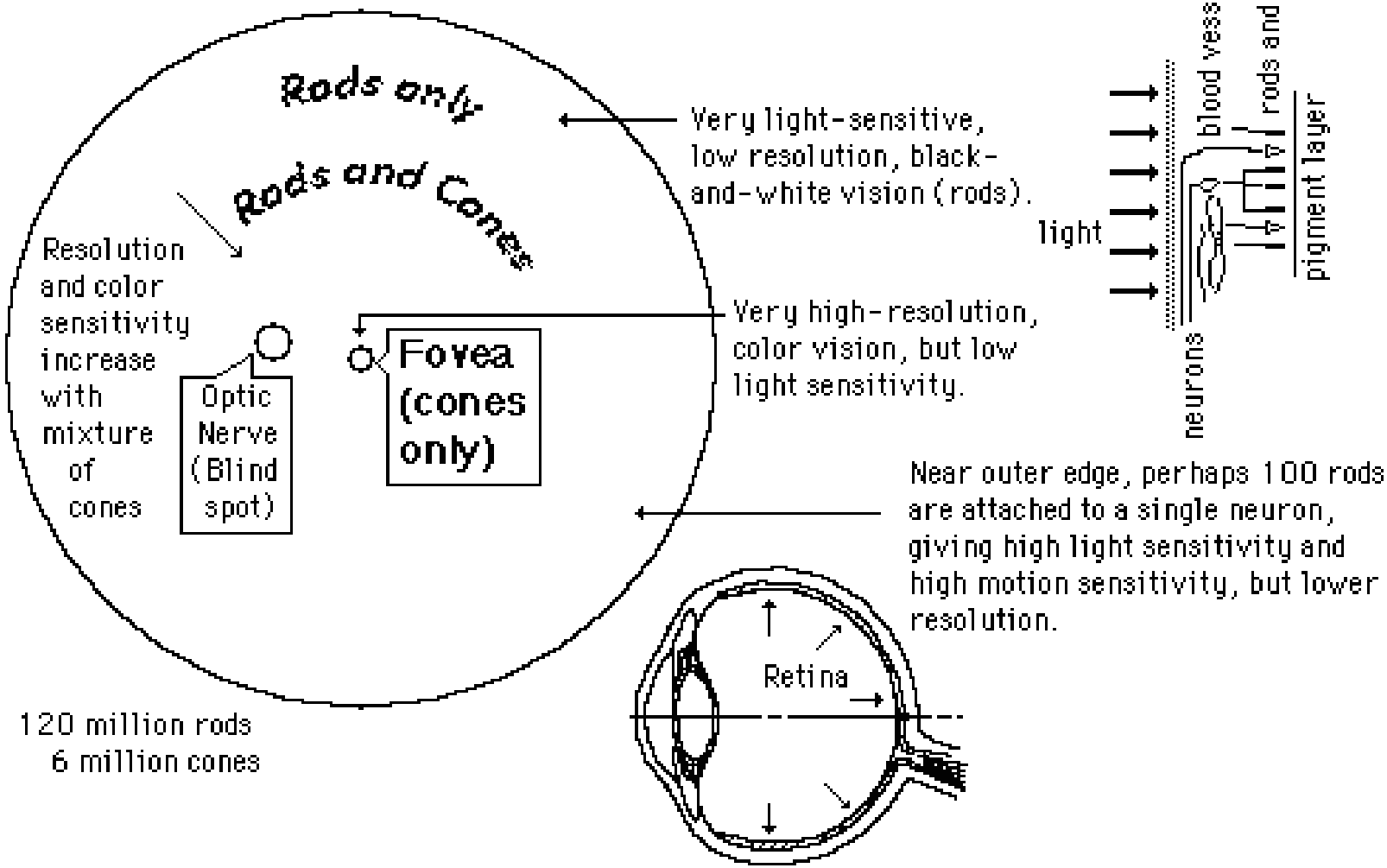
- **Retina**
- **The inside surface of the eye, behind the crystalline lens is covered with a thin layer (0.5 – 0.1 mm) of *light receptor cells (rods and cones)***



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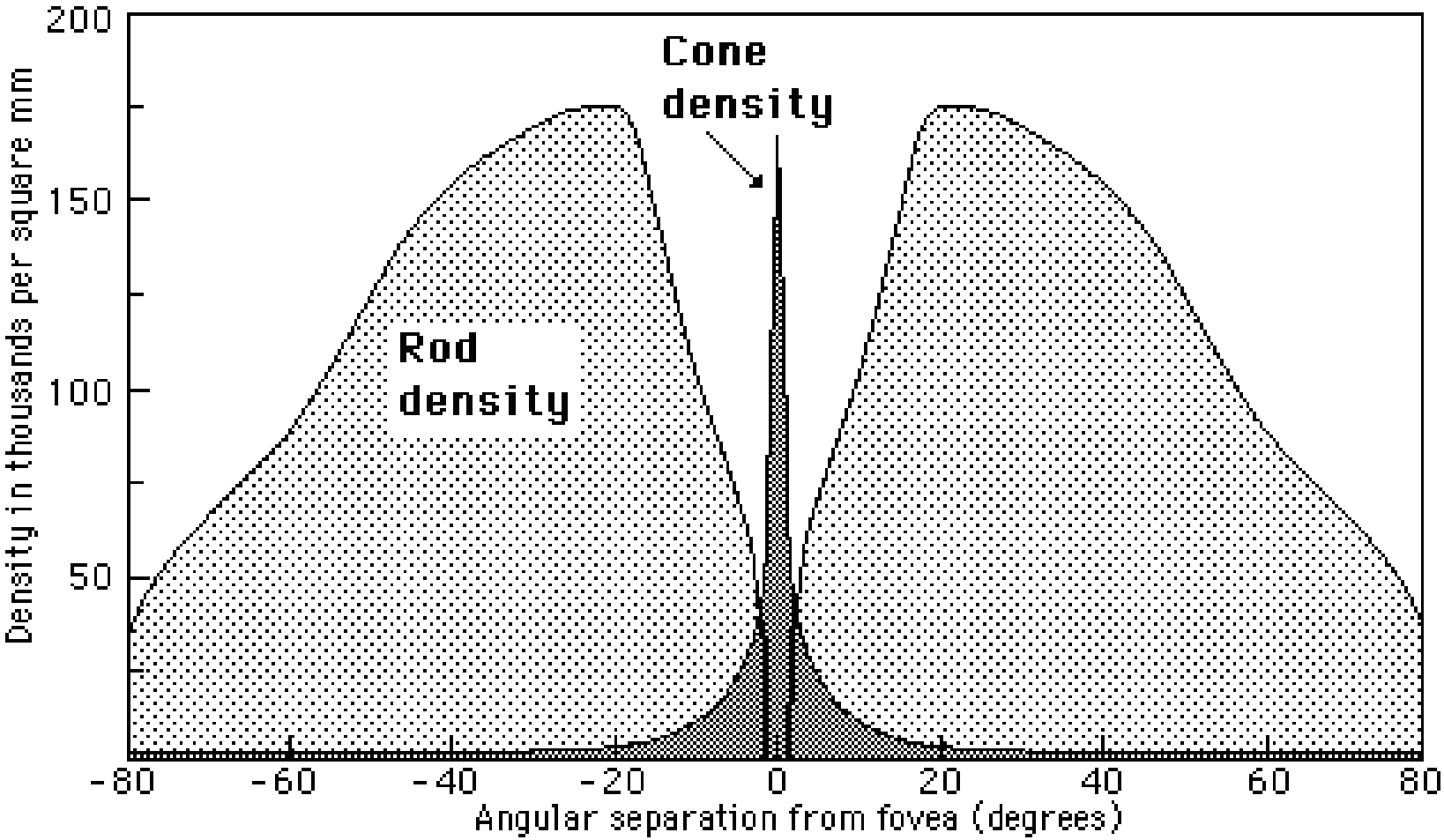
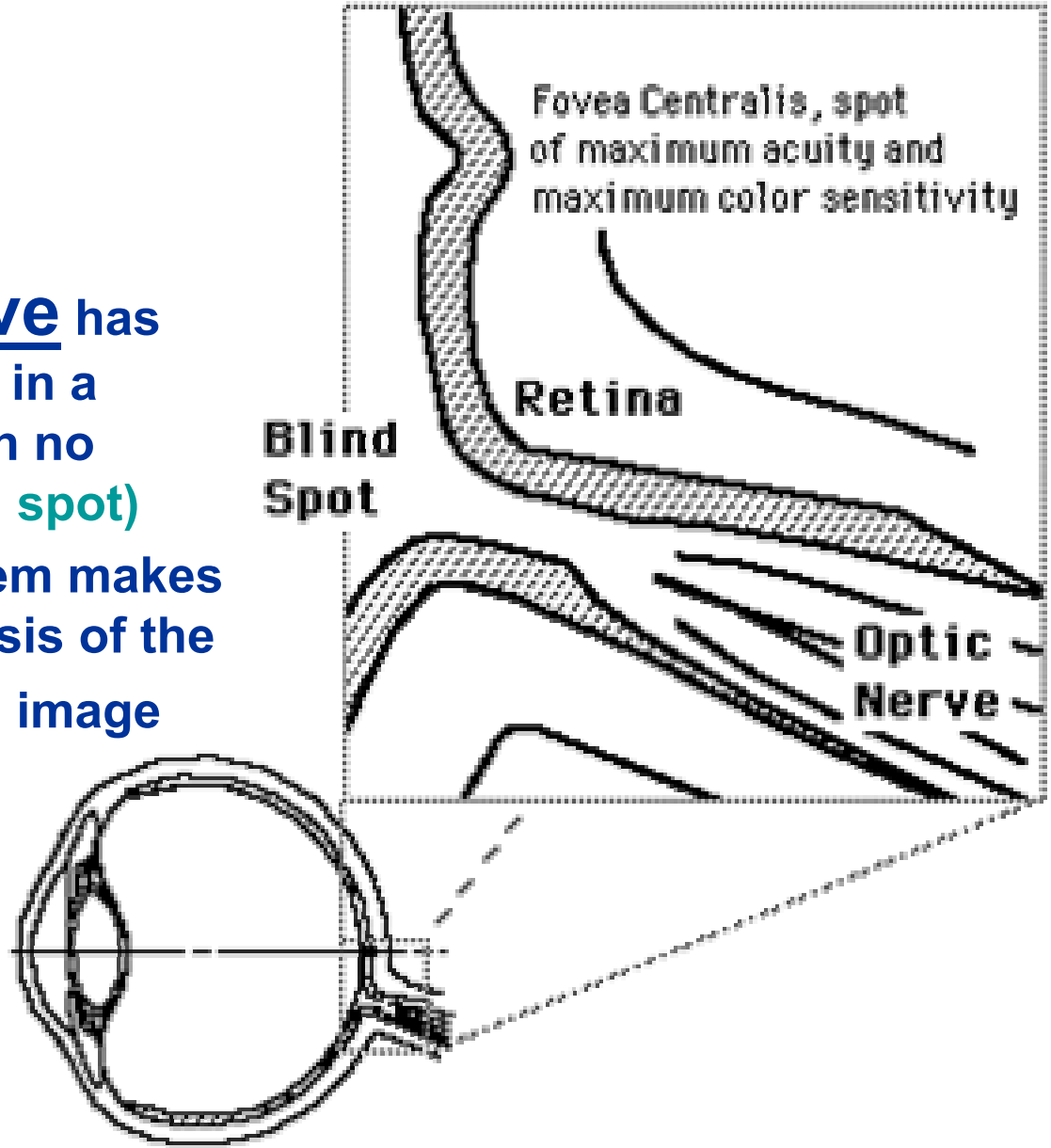
- **Photosensitive cells called rods and cones in the retina convert incident light energy into signals that are carried to the brain by the optic nerve.**



- **The optic nerve** has the departure point in a region of retina with no pigments (the blind spot)
- The eye-brain system makes a continuous analysis of the time-varying retinal image



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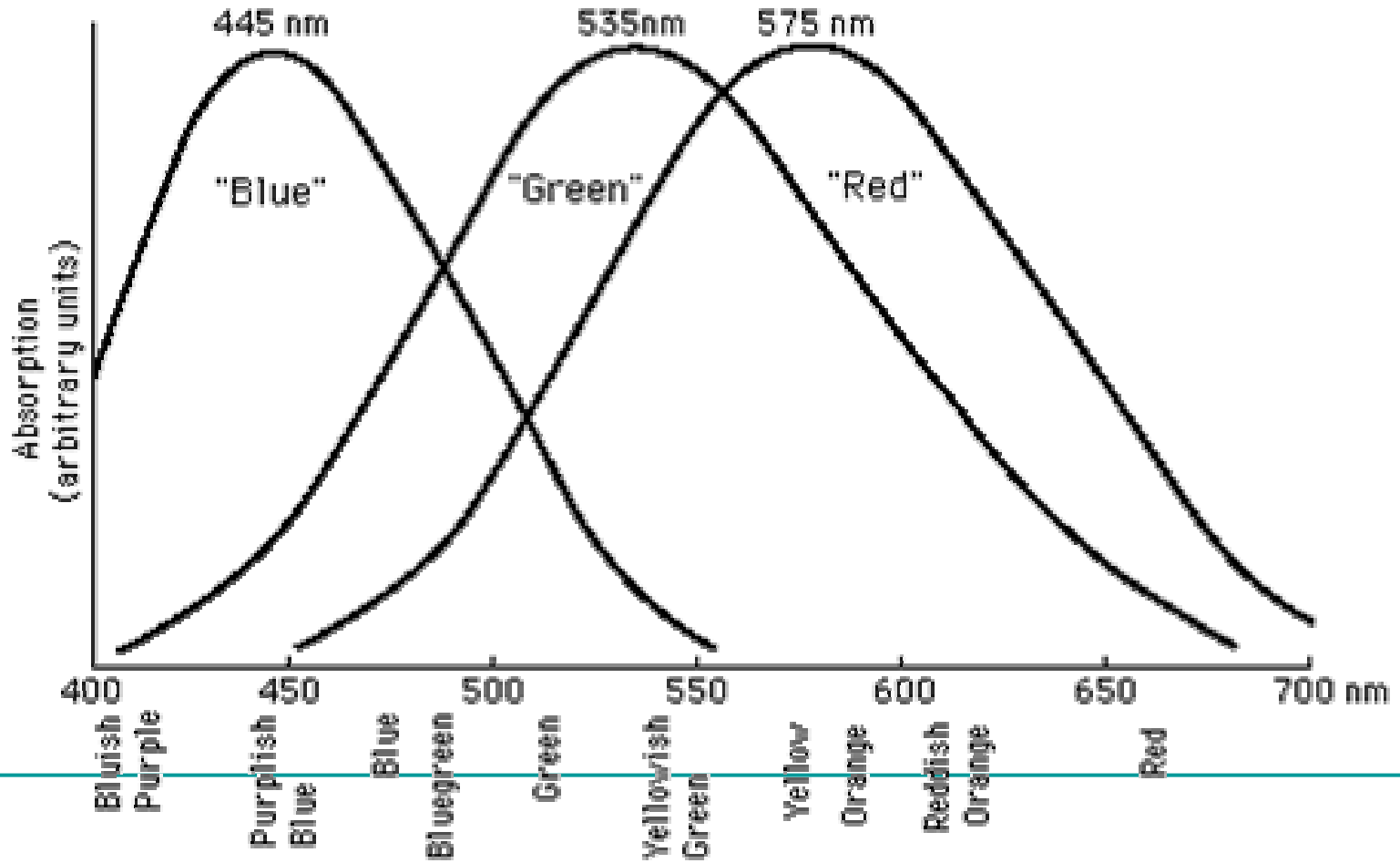
- **Cones** are responsible for all high resolution vision and also for color. The 6 to 7 million cones can be divided into "red" cones (64%), "green" cones (32%), and "blue" cones (2%) based on measured response curves.



- **Rods** are not sensitive to color. They are responsible for our dark-adapted, or *scotopic*, vision. The rods are incredibly efficient photoreceptors, more than thousand times as sensitive as the cones. Rods do not see red; their light response has a maximum in the blue.

- **The light signal through retina**: