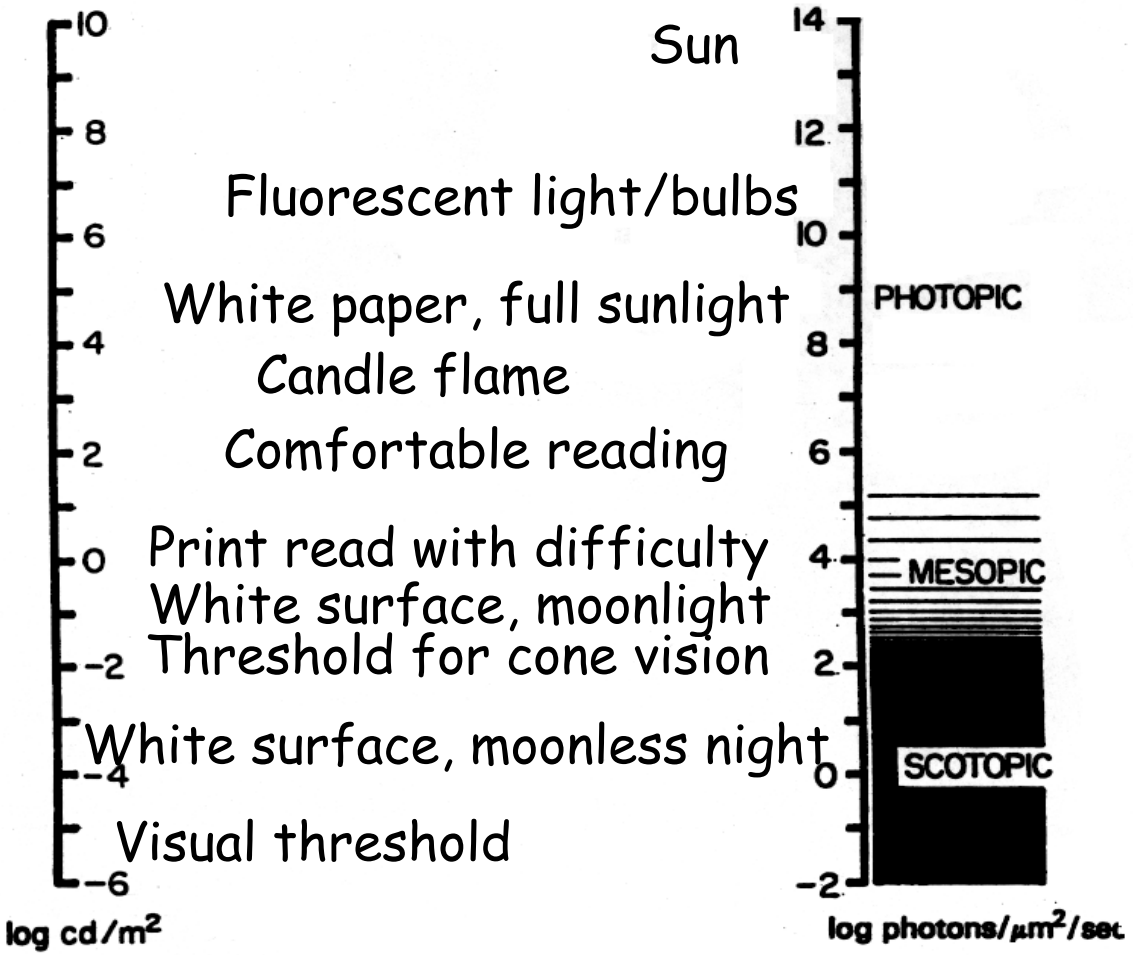
http://mvr.mcgill.ca/Robert/rhess_home.html

Luminance and retinal illumination

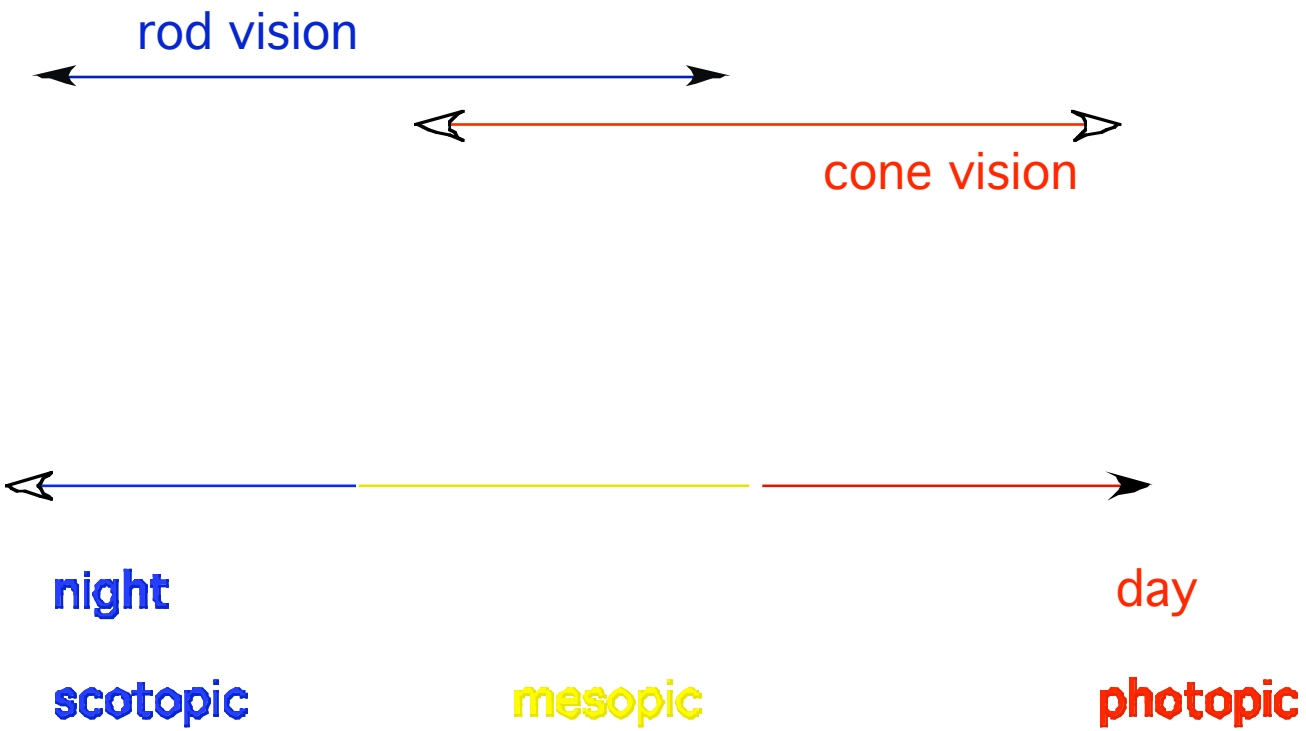


The range of luminances (left) and retinal illumination (right) found in the natural world

How can we see over 15 log units of illumination?

- 1. Duplex function
- 2. Cellular adaptation

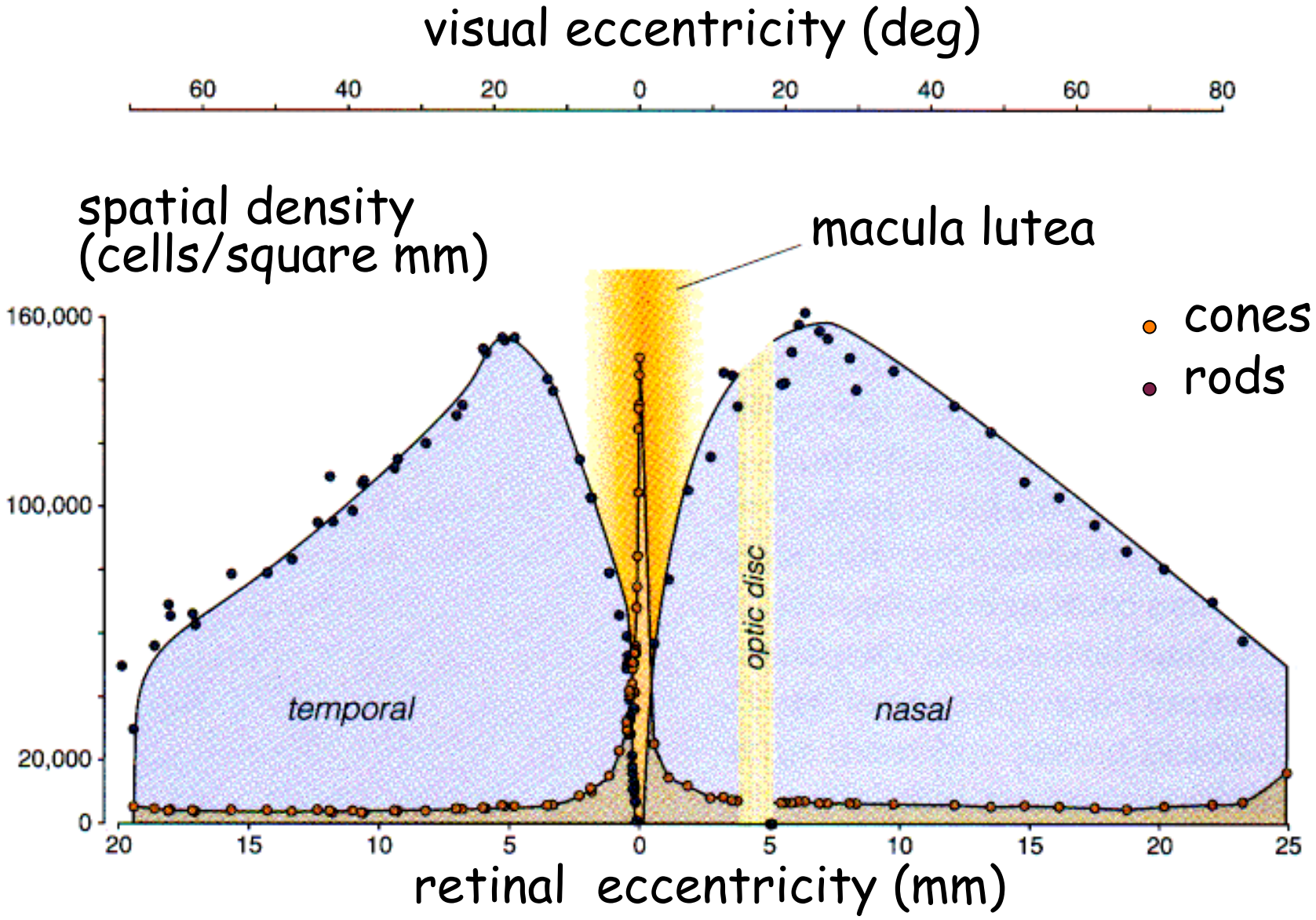
Rod and cone operating ranges



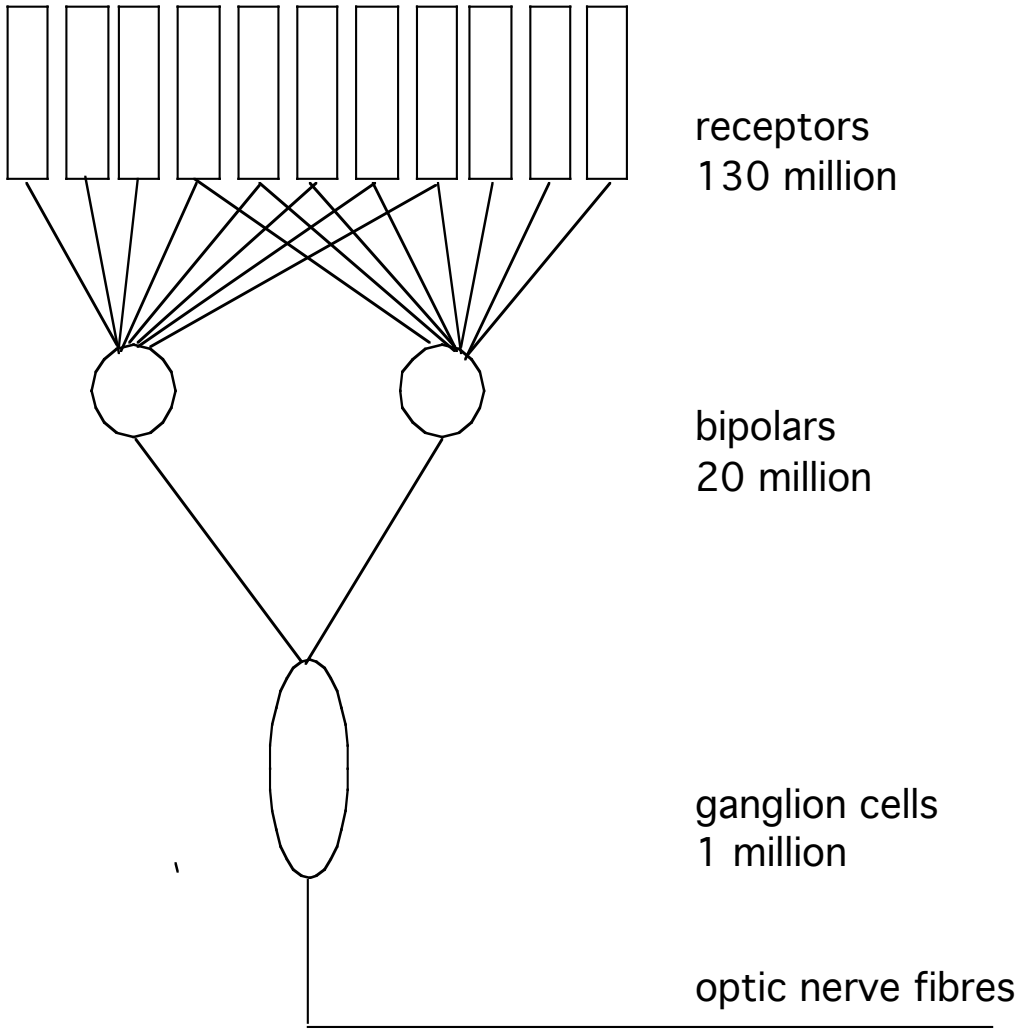
Duplex function

- 1. Rods are more sensitive than cones (x50)
- 2. There are more rods than cones (x10)
- 3. Ganglion cells have larger RFs for rods than cones (i.e. more post-receptoral summation)

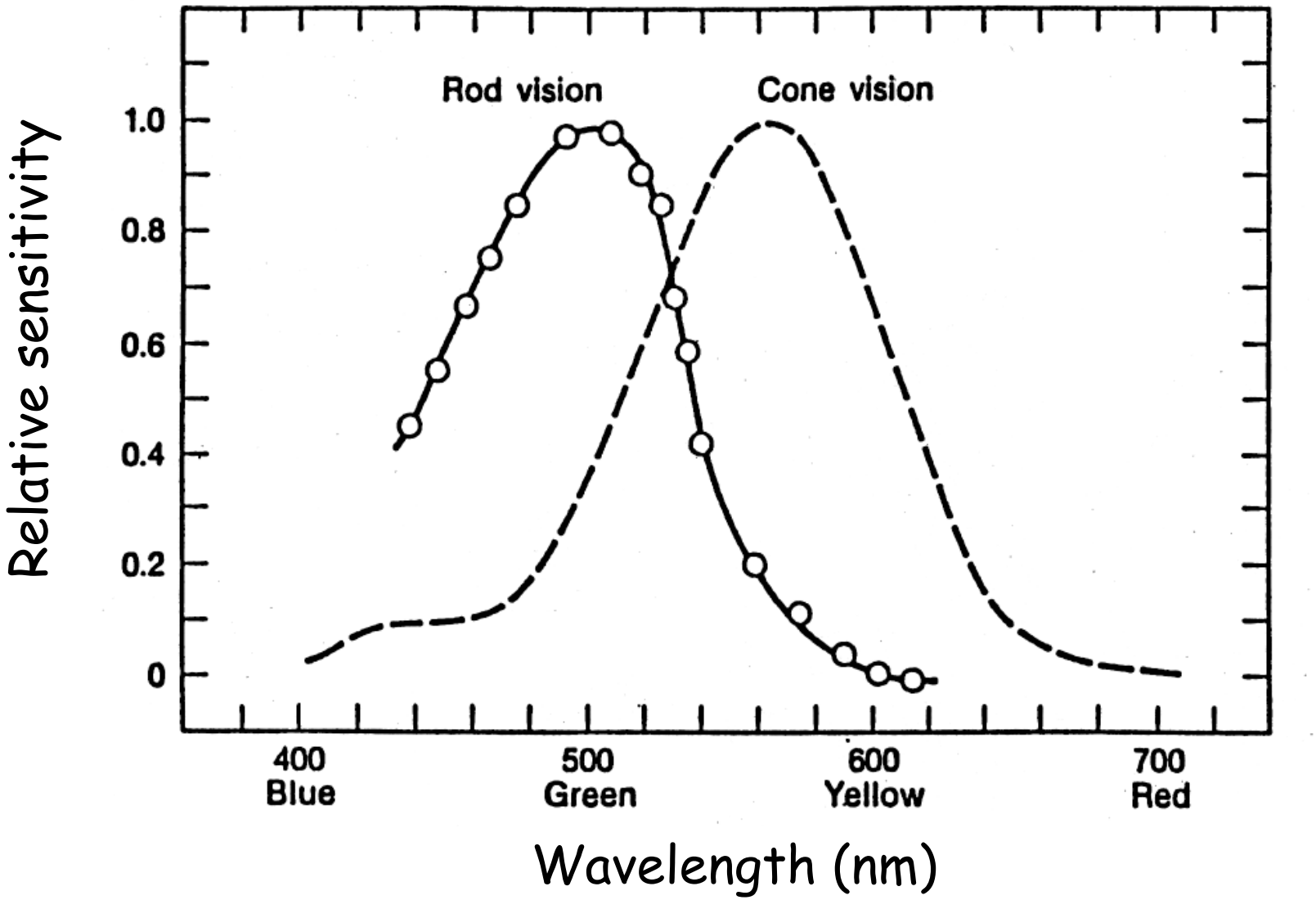
2. Distribution of rods and cones



Convergence



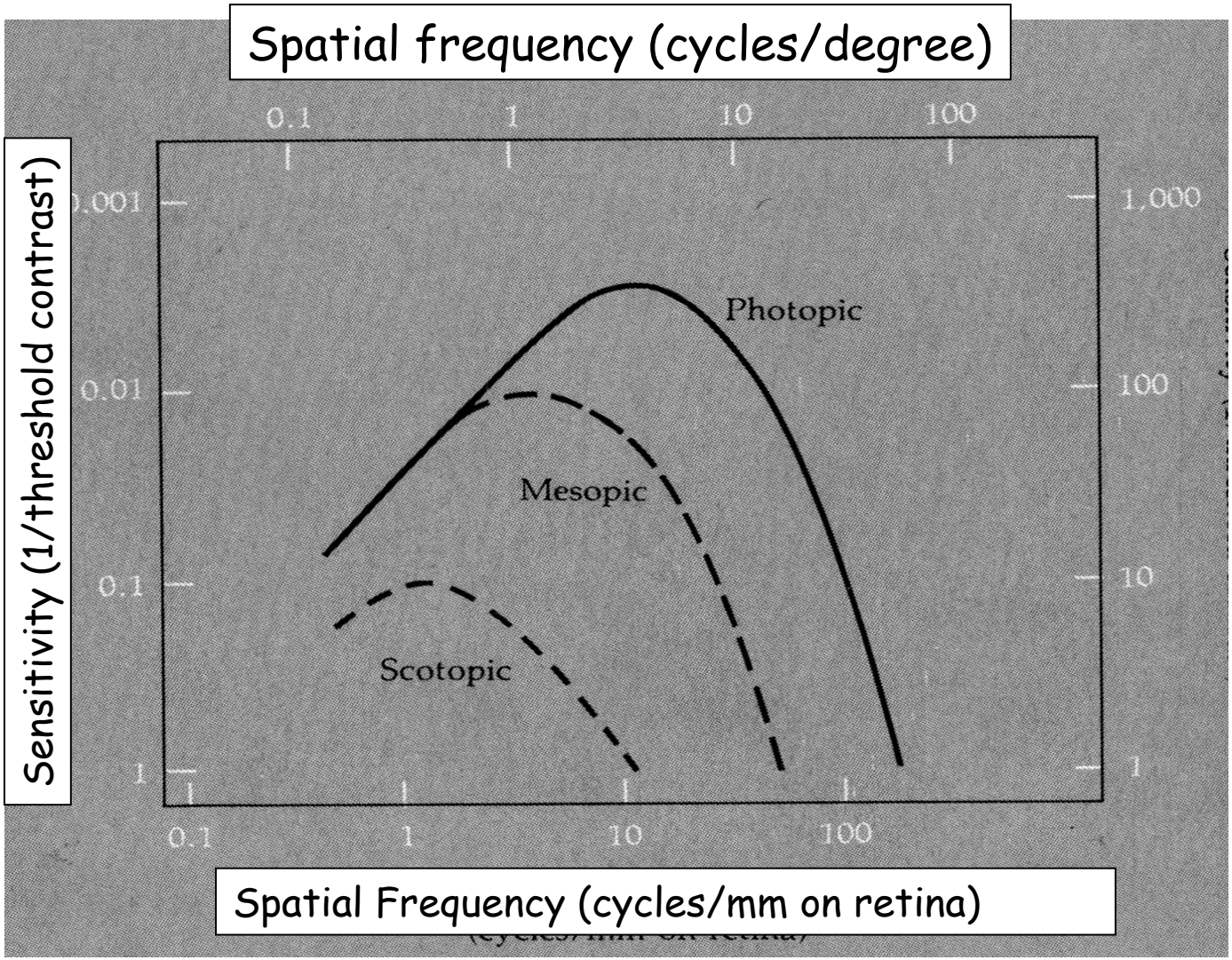
3. Spectral sensitivity curves for rod and cone vision



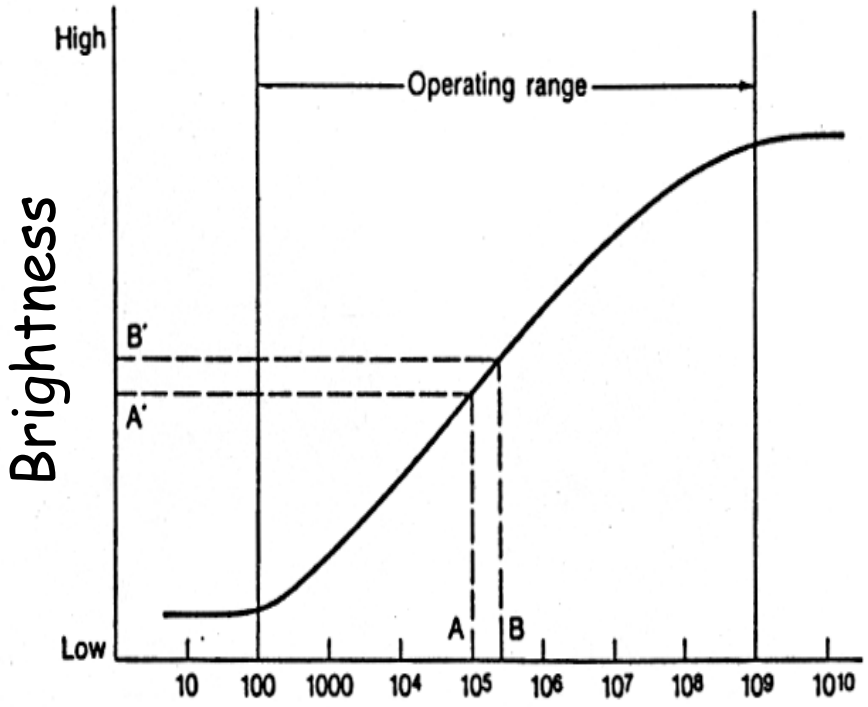
Purkinje effect

- A shift in the colour appearance at dusk.
- Reds look darker, blues look brighter

1. Contrast sensitivity functions at three different light levels

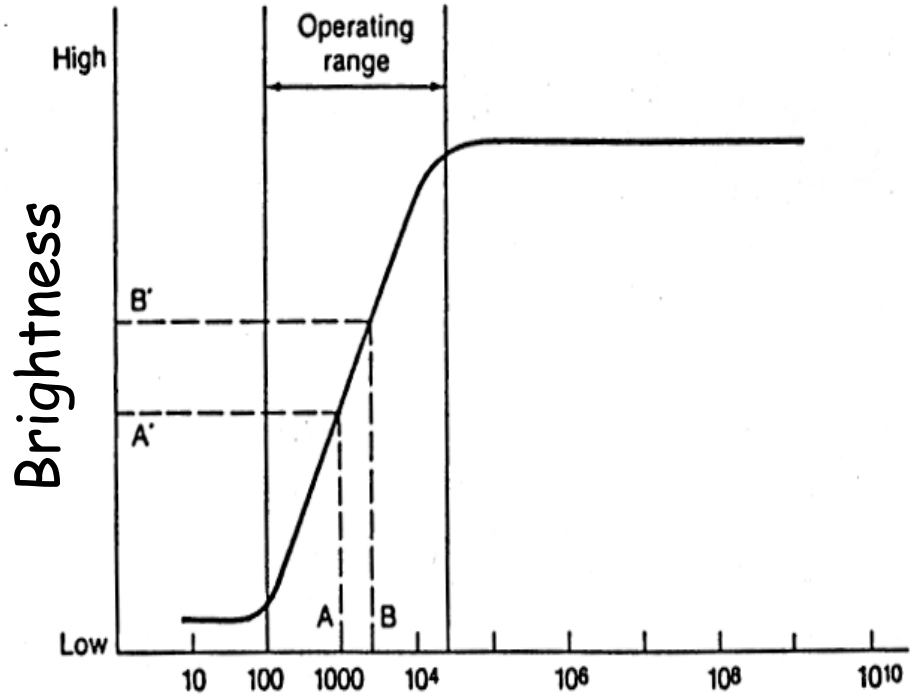


Contrast sensitivity and operating range



Relative light intensity

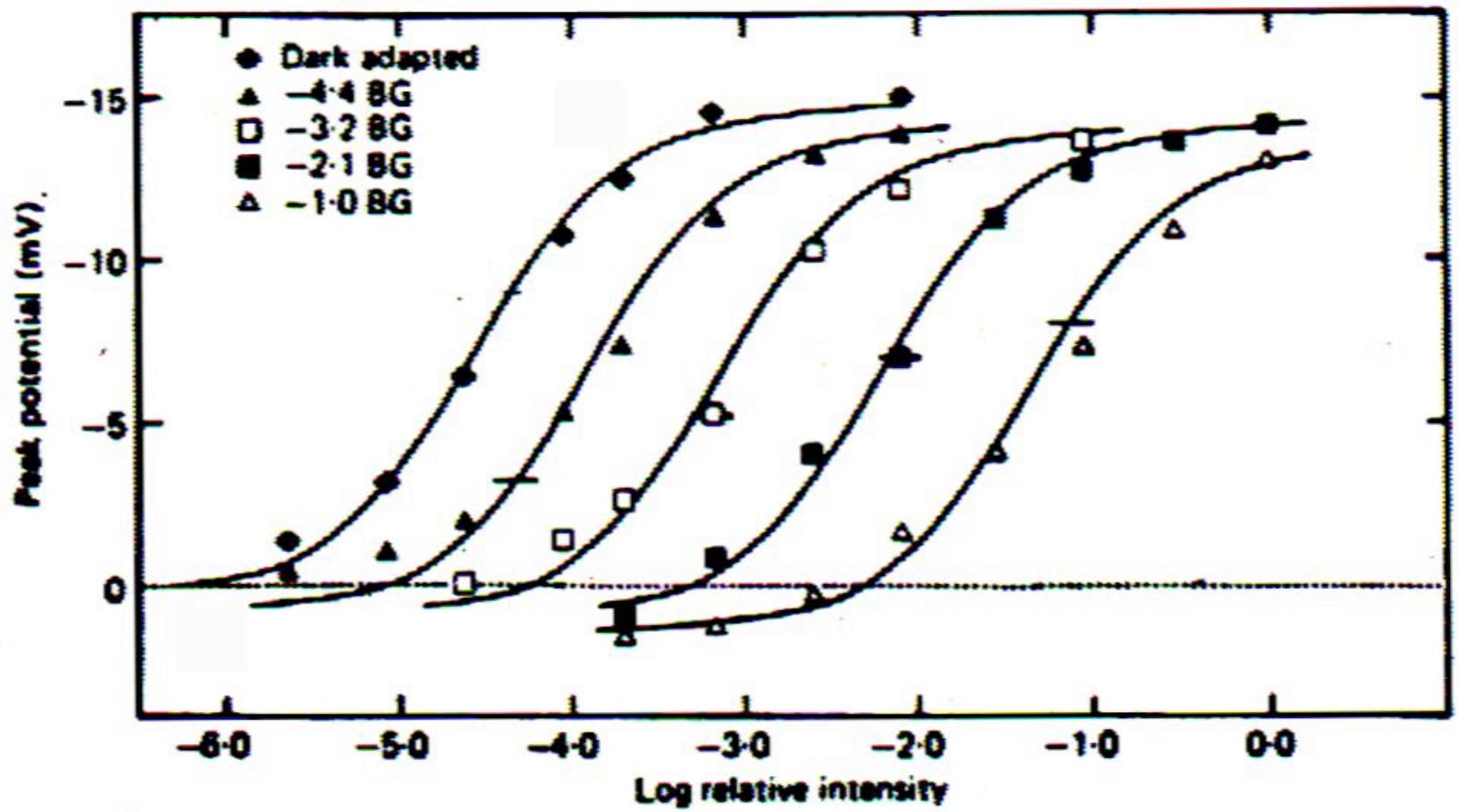
Large operating range but poor contrast sensitivity



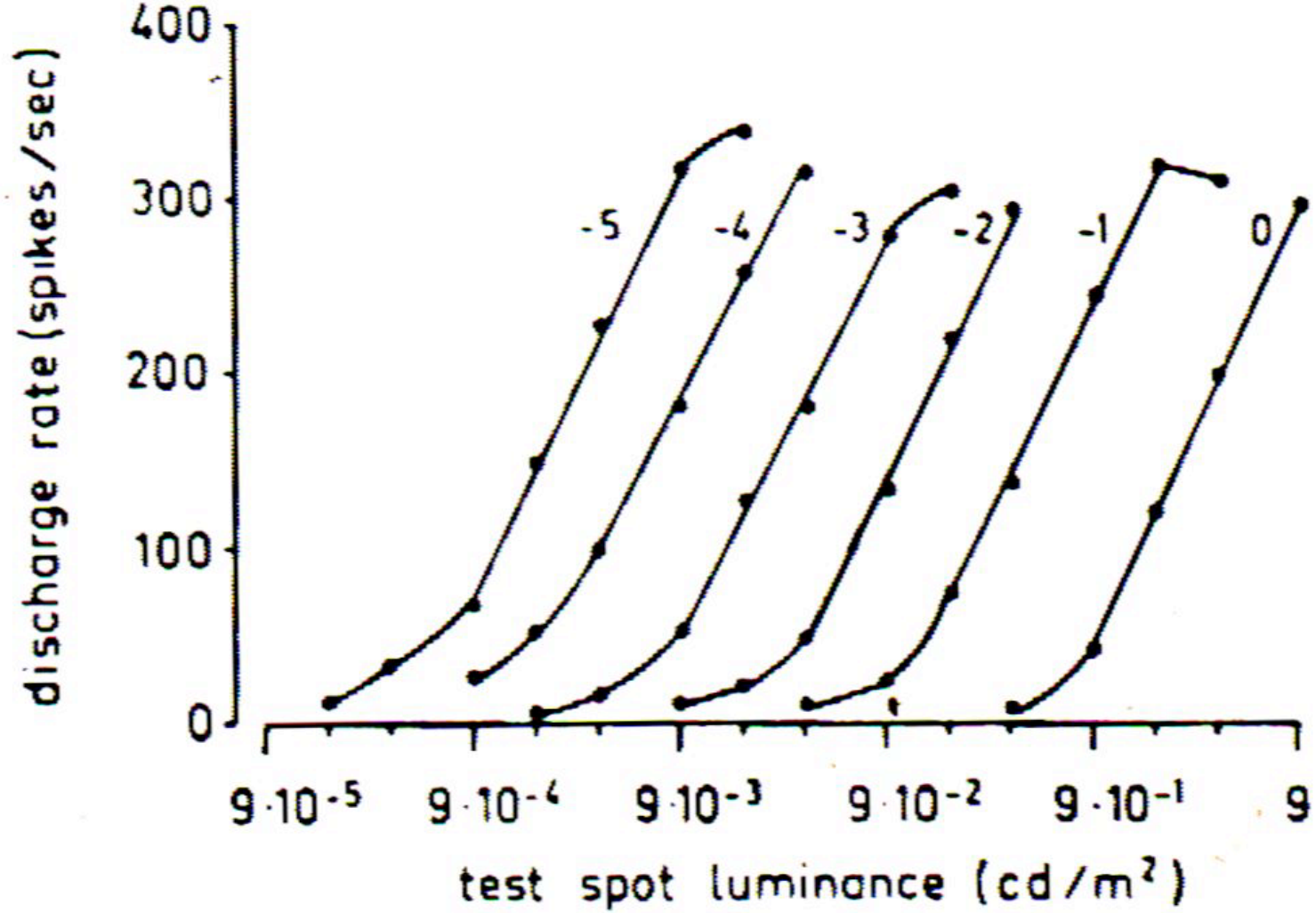
Intensity

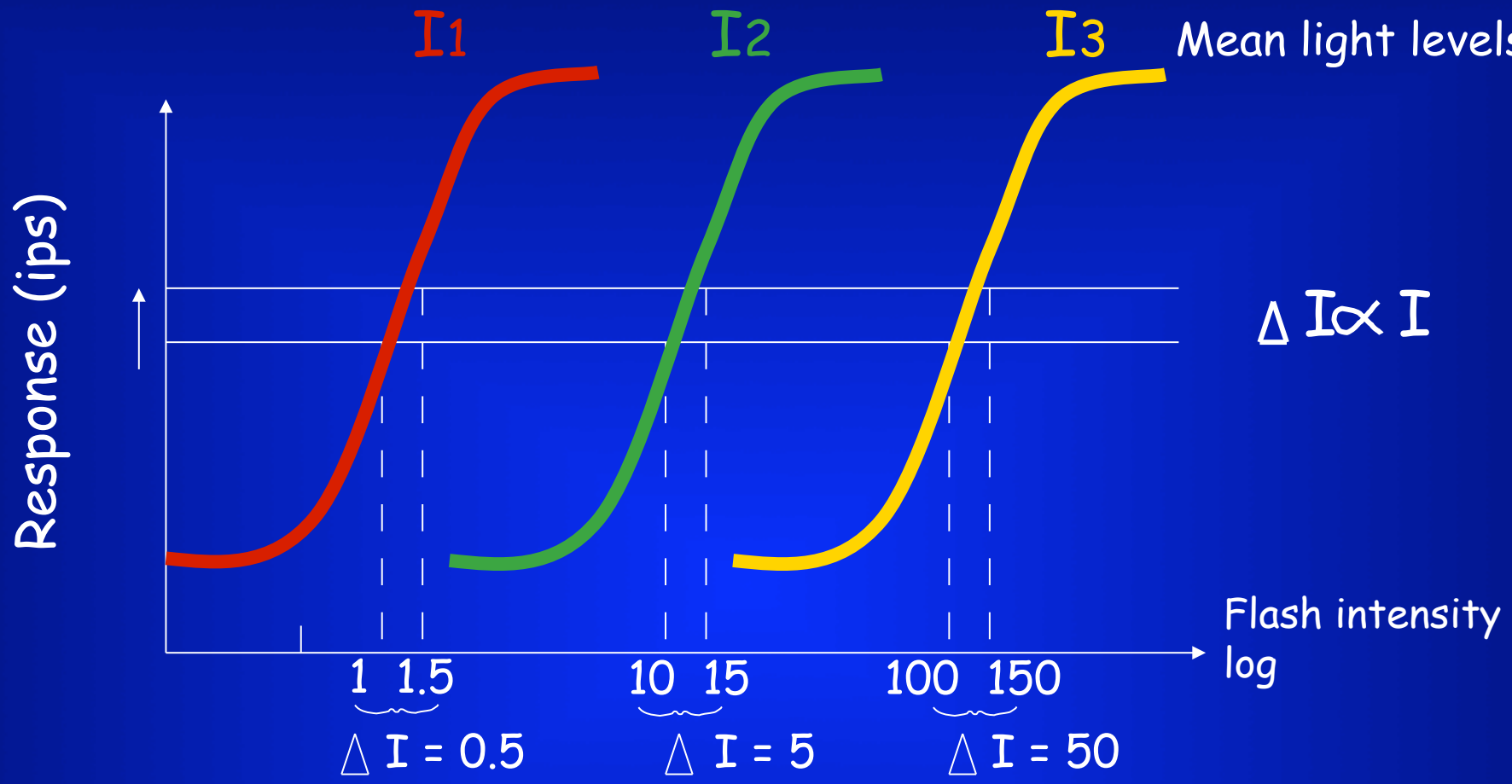
Good contrast sensitivity but small operating range

Receptoral adaptation



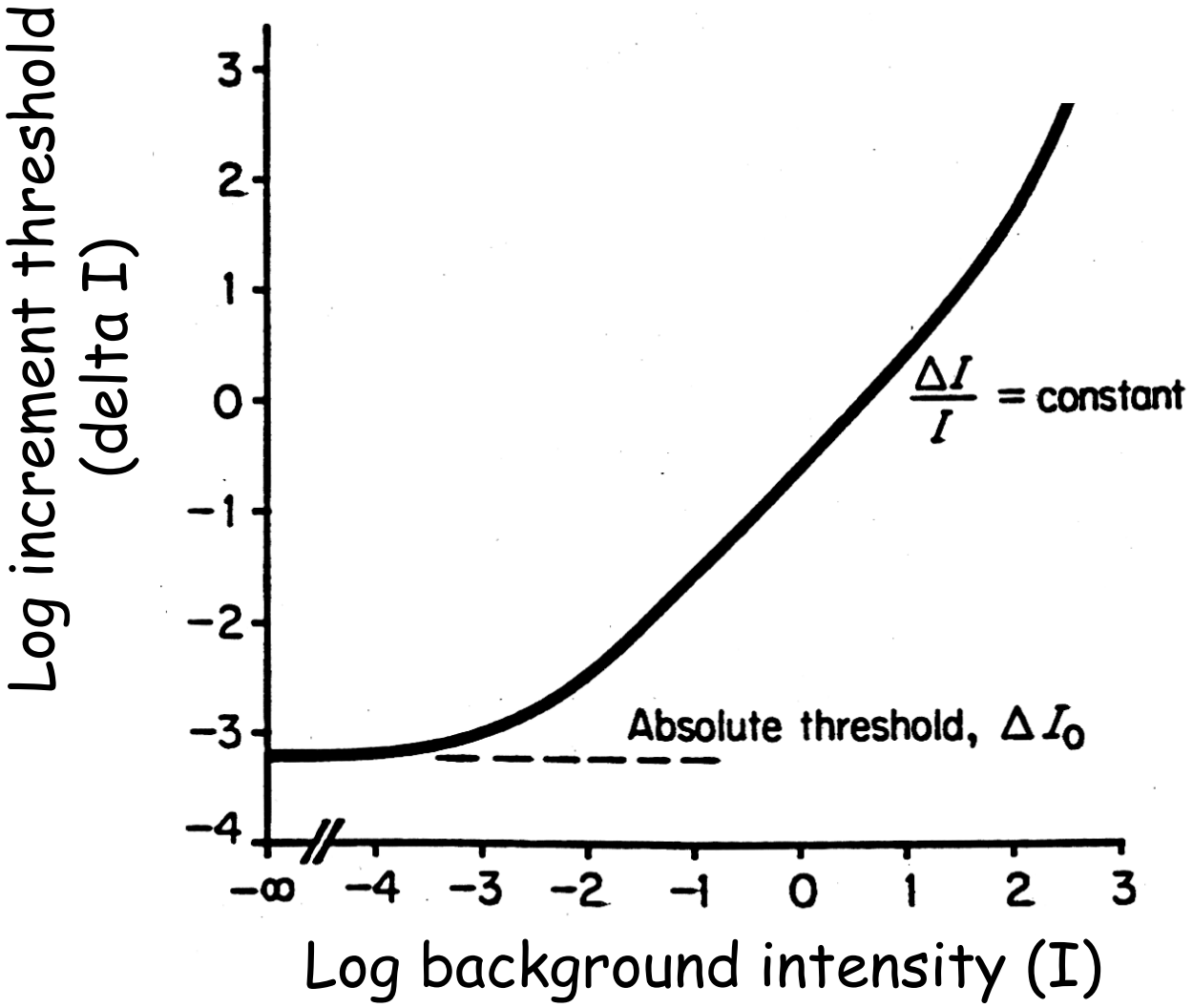
Ganglion cell adaptation





A single neuron can shift its operating range according to the mean light level. The light increment (delta I) required to obtain a criterion response is scaled up or down, according to the mean light level. This is known as GAIN CONTROL.

Increment threshold curve



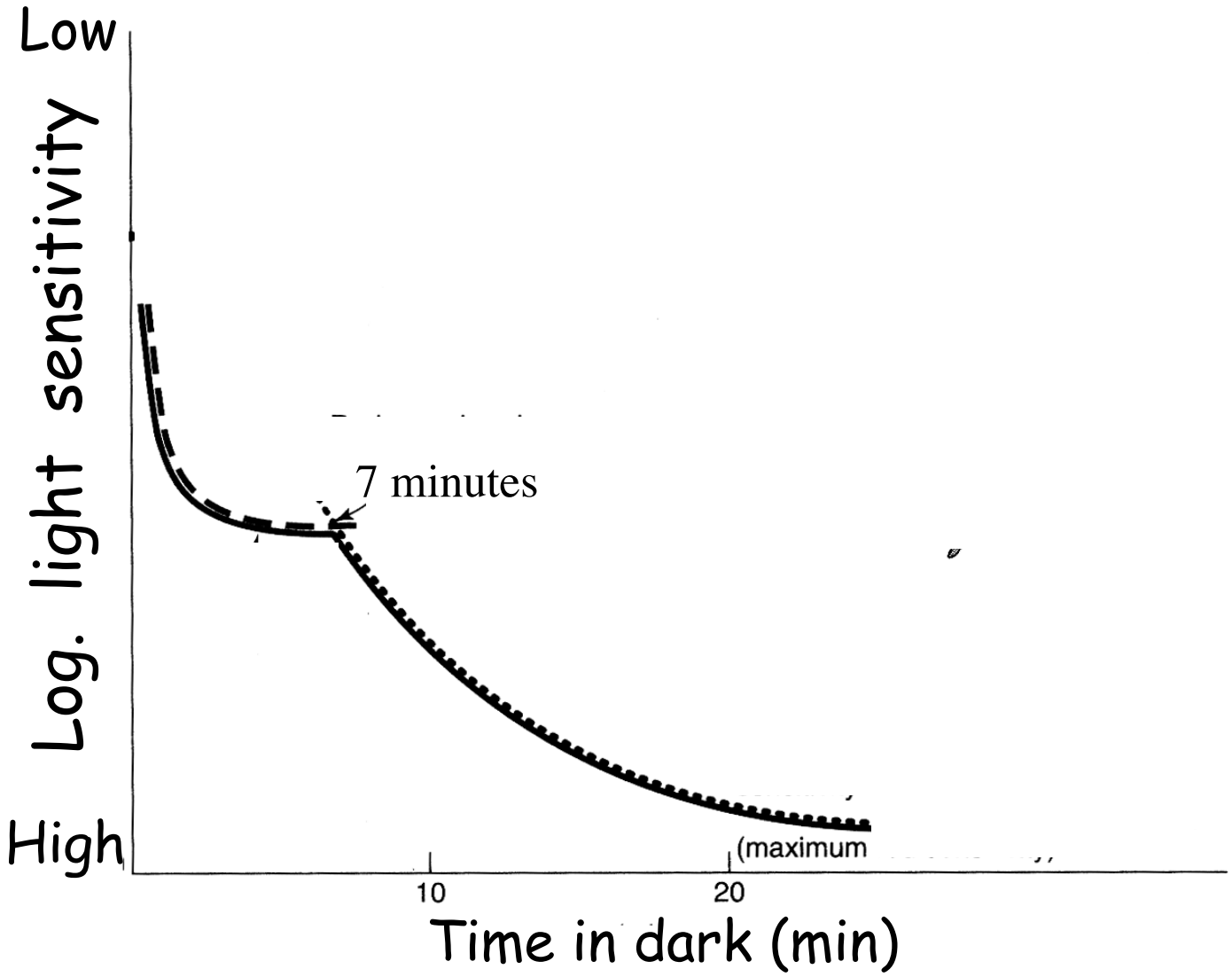
WEBER'S LAW

Weber's Law

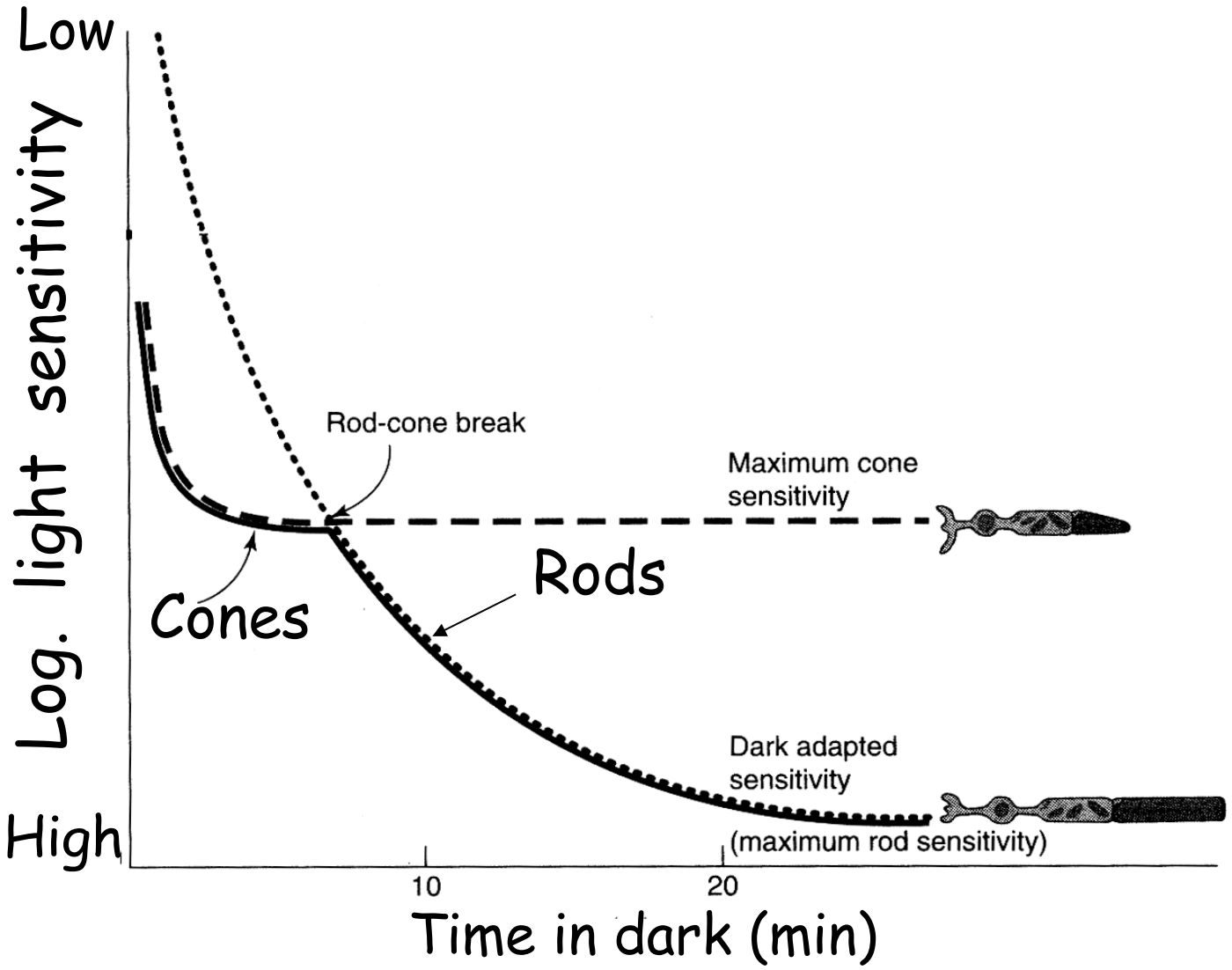
$\Delta I/I$ = constant

- Our sensation is determined by the percentage difference in the luminance of a surface relative to its background
- This holds over a wide range of background (ambient) luminances

4. Sensitivity to light of rods & cones: Dark Adaptation



Dark adaptation curves



Rods & cones: 4 key differences between scotopic and photopic vision

- Contrast sensitivity
- Distribution of rods and cones
- Spectral sensitivity of rods and cones
- Sensitivity to light of rods and cones.