Range of Visual Sensitivity: Scotopic, Mesopic, Photopic

<table>
<thead>
<tr>
<th>Log cd / m² (with 2 mm dia. pupil)</th>
<th>Scotopic</th>
<th>Mesopic</th>
<th>Photopic</th>
</tr>
</thead>
<tbody>
<tr>
<td>Log photopic trolands</td>
<td>-5</td>
<td>-1</td>
<td>0</td>
</tr>
<tr>
<td>Log scotopic cd / m²</td>
<td>-6</td>
<td>-2</td>
<td>-1</td>
</tr>
<tr>
<td>Log scotopic trolands</td>
<td>-4</td>
<td>-2</td>
<td>0</td>
</tr>
</tbody>
</table>

Figure 3.5. Scotopic, mesopic and photopic ranges for the macaque retina. (R. G. Smith, personal communication).

Photoreceptors in primates: humans and monkeys

S-cone  M-cone  L-cone  rod
Spectral Sensitivity

Visual pigments: seven membrane-spanning loops

adapted from Hargrave et al. 1984
Plantanida, 1991
Visual pigments: homologies in amino acid sequences

Phototransduction – a well studied G-protein cascade

Rod opsin (rhodopsin) in the rod disc membrane can be activated by light when 11-cis retinal is bound to it.
The visual cycle: RPE provides 11-cis-retinal for rods


Details of the visual cycle
Biochemical steps in the phototransduction cascade

Phototransduction

Leads to closure of a cation channel in the plasma membrane. This interrupts the dark current, and hyperpolarizes the rod or cone photoreceptor.

The opsin in the outer segments, catches light and is activated when 11-cis retinal is attached to it.
Rod photocurrents: prolonged responses

Cone photocurrents: brief responses

Individual rods are 70-100 times more sensitive than cones

Psychophysically measured sensitivity

Figure 8. Scotopic (rods) and photopic (cones) spectral sensitivity functions. W.A. data from Dawson, H., Physiology of the Eye, 8th ed. London: Macmillan Academic and Professional Ltd, 1990.
Rod and cone sensitivity: During dark adaptation and recovery from bleaching of photopigment, cones recover sensitivity more quickly than rods. (Cone visual cycle can occur in Mueller cells)