What is dark adaptation?

Sensitivity recovery following a bright light which bleaches the rods and the cones.
Rod photoreceptor (opsin + 11-cis retinal)

Rhodopsin

Light

Association

Bathorhodopsin

Lumirhodopsin

Metarhodopsin

Metarhodopsin I

Metarhodopsin II Dissociation

all-trans retinal

all-trans retinol

11-cis retinal

11-cis retinol

RETINOID CYCLE

RPE cell

Dark adaptation and the retina
How do we measure dark adaptation?
How do we measure dark adaptation?

- Measured on a CRT monitor
- CRT's luminance range extended using ND filters
- Test area bleached using an electronic flash
- Thresholds measured for 30 mins using MOA
- Monocular viewing with a dilated or natural pupil
- Unstimulated eye patched
Factors affecting dark adaptation

- Percentage of bleach
Factors affecting dark adaptation

- Age: Dark adaptation becomes slower with age
  
  Mean rate of S2 for younger group: $0.23 \pm 0.03 \log_{10} \text{units min}^{-1}$
  
  Mean rate of S2 for older group: $0.19 \pm 0.03 \log_{10} \text{units min}^{-1}$
Factors affecting dark adaptation

- Age:
  Older group significantly slower than the younger group 
  \(r = 0.62, F[1,32] = 18.77, p < 0.0002\)
  The rate of S2 recovery decreased 0.01 log units/min per decade.

Cause for this is unknown but may be related to ageing of the RPE/Bruch’s membrane complex.
Factors affecting dark adaptation

- Nutrition: Vitamin A
  Vitamin A–deficient patient before (●) and after (○) treatment with vitamin A.

Factors affecting dark adaptation

- Nutrition: **Lutein**
  Significant improvement in rod-mediated dark adaptation in a placebo-controlled study following lutein supplementation in 71 early AMD patients.

Berendschot et al, 2011, IOVS ARVO abstract.
Factors affecting dark adaptation

- Medications: Isotretinoin (Accutane)

Weleber, 1986, Arch ophthalmol, Vol 106
Factors affecting dark adaptation

- **Fenretidine**
  - a synthetic retinoid used to treat various types of cancer
  - delay in the timing of the rod-cone break

![Graph showing dark adaptation](image)

Measured at baseline (open circles) and on day 24 (solid circles)

Why measure dark adaptation?

- Eye disease: **AMD**

![Graph](image-url)

Why measure dark adaptation?

- Eye disease: **Diabetes**

Why measure dark adaptation?

- Rods are more susceptible to intense light–induced damage than cones
- Scotopic function is an important marker of many retinal diseases
- Earliest sign of vision loss in normal ageing and AMD even before loss of VA and before clinical signs
- Extremely sensitive measure of retina health therefore used as an outcome measure in clinical trials