EYES IN SCIENCE

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QUIZ TIME!

- Retina
- Iris
- Cornea
- Lens
- Optic Nerve
QUIZ TIME!

CORNEA

LENS

IRIS

RETINA

OPTIC NERVE
HOW DOES THE EYE WORK?
FUNCTIONS:
1. Physical barrier vs exterior
2. Transparent → allows light to pass through
3. Refracts / bends light → focuses light
The cornea acts like the anterior lens of a camera.
FUNCTION:
1. Eye colour
2. Controls the amount of light that enters the eye
The iris acts like the aperture / shutter of a camera
LENS

FUNCTION:
1. Changes shape and thickness to focus light rays
2. Transparent → allows light to pass through

DISTANT OBJECT

NEAR OBJECT
The lens acts like the lens of a camera.
FUNCTION:
1. Converts light into electrical signals
2. It creates an upside-down image
The retina acts like the film / image sensor of a camera
FUNCTION:
1. Collects visual information from all the parts of the retina
2. Acts like a wire to transport electrical information
FUNCTION:
1. Receives the electrical information from the optic nerve and optic tract
2. Processes the electrical information → creates the image the right way up
The brain acts like a processor.
MYOPIA / SHORT-SIGHTEDNESS

The eyeball is LONGER than normal → focus in front of the retina → DISTANT objects are blurry

https://www.asiapacificeyecentre.com.sg/myopia/
The eyeball is SHORTER than normal → focus behind the retina → NEAR objects are blurry

https://www.asiapacificeyecentre.com.sg/myopia/
The cornea has a different CURVATURE → multiple focal points → image is blurry, glare/halos around lights
• The lens becomes CLOUDY →
  o No clear image
  o Halos around lights
• Usually age-related

https://eyenj.com/cataracts-glen-rock/
MACULAR DEGENERATION

MACULA:
- Most important part of the retina
- Highest density of cone photoreceptors
- Part of the retina for well-defined, central colour vision

Accumulation of EXTRA MATERIAL in the macula
➢ loss of CENTRAL VISION
➢ DISTORTED LINES
MACULAR DEGENERATION:
• Accumulation of EXTRA MATERIAL in the macula
  ➢ loss of CENTRAL VISION
  ➢ DISTORTED LINES
• Age-related
PHOTORECEPTORS

ROD photoceptors:
- Night-time vision (scotopic)
- No colour vision

CONE photoceptors:
- Day-time vision (mesopic)
- Colour vision: sensitive to different wavelengths → different colours:
  - L: long wavelength (~560-570 nm) → red
  - M: medium wavelength (~530-540 nm) → green
  - S: short wavelength (~420-440 nm) → blue

http://www.handprint.com/HP/WCL/color1.html
ROD PHOTORECEPTORS: RETINITIS PIGMENTOSA

Damage / death of ROD photoreceptors:
➢ Night blindness
➢ Tunnel vision

NORMAL VISION

TUNNEL VISION

https://www.srsb.org.uk/Retinitis-Pigmentosa/
# Cone Photoreceptor: Colour Vision Deficiencies

<table>
<thead>
<tr>
<th>Cone</th>
<th>Colour</th>
<th>Missing cone</th>
<th>Mutated cone</th>
<th>Axis</th>
<th>Visual acuity</th>
</tr>
</thead>
<tbody>
<tr>
<td>L-M-S</td>
<td>All colours</td>
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<td>Incomplete achromatopsia</td>
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<td>Low</td>
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Tondo Doni, Michelangelo, Galleria degli Uffizi, Firenze

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Protanopia
L (red) cone dysfunction
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Deuteranopia
M (green) cone dysfunction
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Tritanopia
S (blue) cone dysfunction
### ACTIVITY: EXAMPLE OF A CLINICAL TRIAL

1. Pick a topic
2. How would you approach this problem?
3. What steps do we need to take?
4. What people do we need?

#### Topics:
- **Refractive errors:**
  - New type of lens
  - World-wide distribution
- **Cataract:**
  - Compare two surgical instruments
  - Compare two antibiotic eye drops
- **Macular degeneration**
  - New type of visual aid
  - New type of therapy
- **Retinitis pigmentosa:**
  - New type of visual aid
  - New type of gene therapy
RESEARCH

- Biology
- Chemistry
- Medicine
- Statistics
- Computer science
- Technician school