

# *HSC Biology*

## *Communication*

*Focus 3:*

 *The clarity of the signal transferred can affect interpretation of the intended visual communication.*

**Identify the conditions under which refraction of light occurs.**

- Light rays generally travel in a straight line.
  - Light bent when hitting an object of different density at an angle other than  $90^\circ$ .
- Refraction:
  - The bending of light.
- When light passes through a medium with a different density (eg. Water) its speed is slowed down.
  - The denser the medium, the more the ray is slowed down.
    - $\rightarrow$  greater refractive index of medium relative to air.
  - If light waves hit object at an angle, they will be refracted.

Identify the cornea, aqueous humor, lens and vitreous humor as refractive media.

- In the eye:
  - Light is refracted when passing from the air through the cornea, to the aqueous humour, to the lens, to the vitreous humour.
  - This allows light emitted from an object to be focussed to a single point on the retina.

Identify accommodation as the focusing of objects at different distances, Describe its achievement through the change in strength of the lens and Explain its importance.

- Accommodation:
  - Reflex action of the eye in response to focussing on a near or distant object.
  - Ability of the lens to change shape to focus scattered rays of light.
  - Allows eye to form focused images on retina from objects ranging in distance.
- Ciliary bodies (muscles) relax & contract to change thickness of lens.
  - Creates convex / concave lens.
  - Focuses light on fovea (most sensitive part of retina).
- If light source close (objects <6m away emit diverging light rays):
  - Lens becomes more rounded to scatter rays.
- If light source distant (objects >6m away emit parallel light rays):
  - Lens becomes flattened to refract light inwards.
- Ciliary muscles:
  - Act on suspensory ligaments.
    - Adjust shape of lens.
  - Relax (ligaments taught):
    - Lens is flattened.
  - Contract (ligaments relax):
    - Lens is more rounded.
- Lens loses elasticity over time.
  - Loses ability to accommodate objects in close proximity.
    - Glasses fix this problem.

Compare the change in the refractive power of the lens from rest to maximum accommodation.

- Accommodation:
  - Reflex action of the eye in response to focussing on a near object then a distant object.
  
- Unaccommodated eye (rest):
  - Lens flattened (convex).
    - Focal length increased.
    - Refractive power decreased.
  - Distant objects in focus.
  - Ciliary body relaxed.
    - Increased tension on suspensory ligaments.
  - Distant object.

**- LESS REFRACTIVE POWER.**
  
- Accommodated eye:
  - Lens fattened (concave).
    - Focal length decreases.
    - Refractive power increased.
  - Close objects focussed.
  - Ciliary body contracted.
    - Tension reduced on suspensory ligaments.
  - Close object.

**- MORE REFRACTIVE POWER.**

**Distinguish between myopia and hyperopia and Outline how technologies can be used to correct these conditions.**

- Myopia:
  - Short sightedness.
    - Ability to see close objects.
  - Light rays focussed in front of retina rather than on it.
  - Eyeball too long.
- Hyperopia:
  - Long sightedness.
    - Ability to see distant objects.
  - Light rays focussed behind retina.
  - Eyeball too short.
  - Age causes lens to harden, reducing affect of accommodation.
- Technologies:
  - *Spectacles*.
    - Convex lenses used to fix hyperopia.
      - Extend focal length.
    - Concave lenses used to fix myopia.
      - Shortens focal length.
    - Force light rays to diverge / converge, causing light to focus on retina.
  - *Contact lenses*.
    - Designed to focus light on the retina.
    - Function based on principle of spectacles.
  - *Refractive laser eye surgery*.
    - Laser used to reshape cornea to a shape that is effective.
      - Reshaped to change refractive power.

Explain how the production of two different images of a view can result in depth perception.

- Depth perception:
  - Ability to recognise 3D objects & their relative position in space.
  - Ability to determine distance of objects.
- Each eye captures a slightly different view of the object.
  - Each side of brain receives to similar images (slightly different angles).
  - 2 images are superimposed at the brain, causing them to appear to have depth.
    - Stereoscopic vision.
  - This allows for the judgement of depth.
- Perception of depth dependent on stereoscopic vision; where 2 images overlap.
  - Greater distance between eyes = less depth perception.

Plan, Choose Equipment or resources and Perform a first-hand investigation to model the process of accommodation by passing rays of light through convex lenses of different focal lengths.

- Place lens (concave / convex) in lens holder.
- Tape piece of white paper to the wall.
- Light candle.
- Position to form image on paper.
- Measure distance, record observations.
  - Colour.
  - Size.
  - Inversion.
  - Detail.
- Keep distance between lens & paper constant for each test.

Analyse information from secondary sources to Describe changes in the shape of the eye's lens when focusing on near and far objects.

- Close object:
  - Ciliary bodies squash lens into short & dense shape.
    - Ciliary bodies contract.
  - Curvature of lens increased.
    - More refraction.
  - Maximum accommodation when object very close.
  
- Distant object:
  - Ciliary bodies pull lens into long, thin shape.
    - Ciliary bodies relaxed.
  - Curvature of lens decreased.
    - Less refraction.

Process and Analyse information from secondary sources to Describe cataracts and the technology that can be used to prevent blindness from cataracts and use Available Evidence to Discuss the implications of this technology for society.

- **Cataracts:**
  - Condition where natural lens is gradually covered by clumps of protein.
    - Eventually becomes opaque, preventing light from entering retina.
  - Due to:
    - Age.
    - Exposure to UV light.
- Symptoms:
  - Clouded / blurred vision, gradually worsening.
  - Sensitivity to light.
- Groups at risk:
  - Elderly.
- Cataract surgery:
  - *Intraocular lens implantation.*
    - Synthetic lens planted in eye to replace natural lens.
      - Also designed to block U.V. rays.
  - *Phacoemulsification (small incision, no stitch).*
    - Natural lens broken up using ultrasonic sound waves, vacuumed out.
    - Synthetic lens implanted into existing space.
    - No stitches needed.
    - Incision into sclera may be required to remove if lens too hard.
- Complications of surgery & side effects:
  - May cause discomfort.
  - Possible eye trauma.
  - Botched surgery.
- Implications for society:
  - Increase quality of life.
  - Provide people with sight.
  - Increase life expectancy.
  - Reduce burden on health care facilities.