6.2 Extending Human Vision

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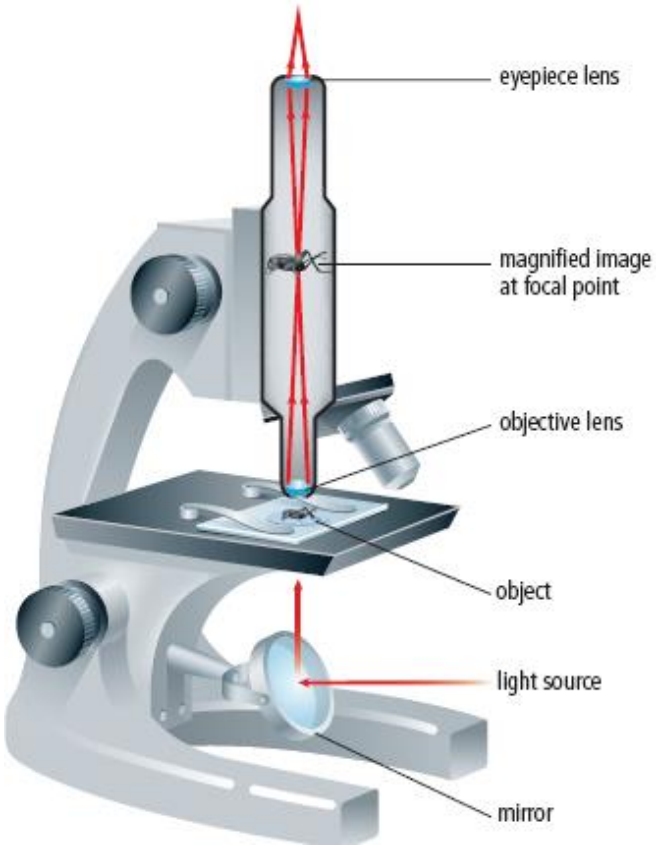
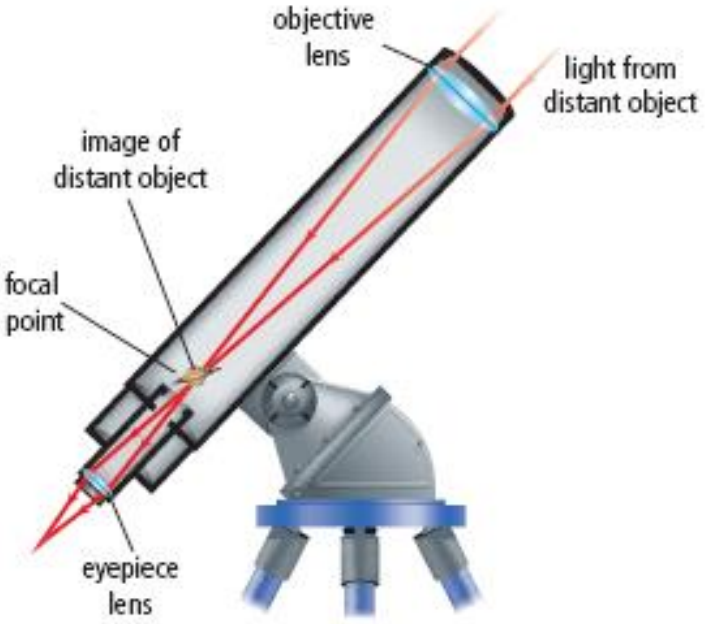
Microscopes

- A compound light microscope uses two convex lenses to magnify small, close objects.
  - Magnify means to make the image look larger than the real size.
- To focus the image, the object is moved closer to or farther away from the object lens.



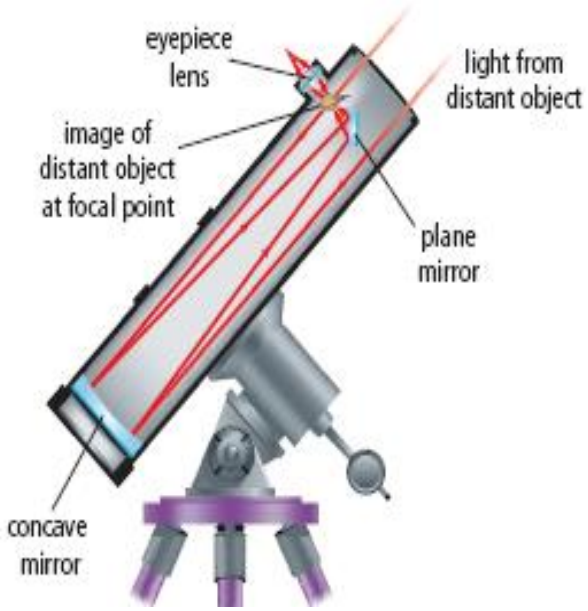
Refracting Telescopes

- A refracting telescope has a convex lens to collect and focus light from a distant object, and a convex eyepiece lens to magnify the image.
- Problems with refracting telescopes include:
  - Large objective lenses flex, due to their own weight and distort the image.
  - Glass lenses, even of the highest quality, absorbs some of the light and are expensive.



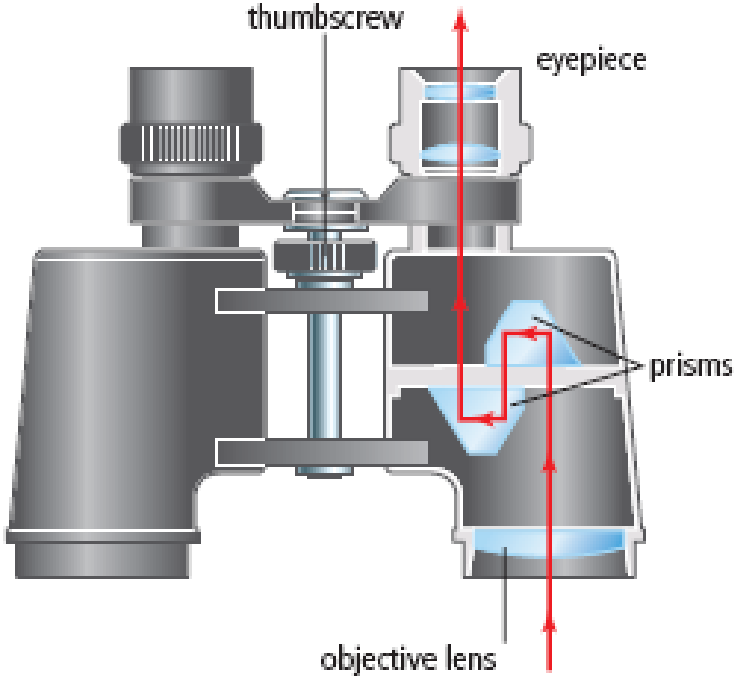
Reflecting Telescopes

- A reflecting telescope uses a concave mirror, a plane mirror, and a convex lens.
  - Light enters the telescope and is focused after reflecting off the concave mirror.
  - A plane mirror reflects the light towards the eyepiece.
  - The convex lens in the eyepiece magnifies the image.
- Most large telescopes are reflecting telescopes.



Binoculars

- Binoculars are actually two refracting telescopes mounted side by side.
- To shorten the length of the tubes in binoculars, prisms are used to reflect the light back and forth.



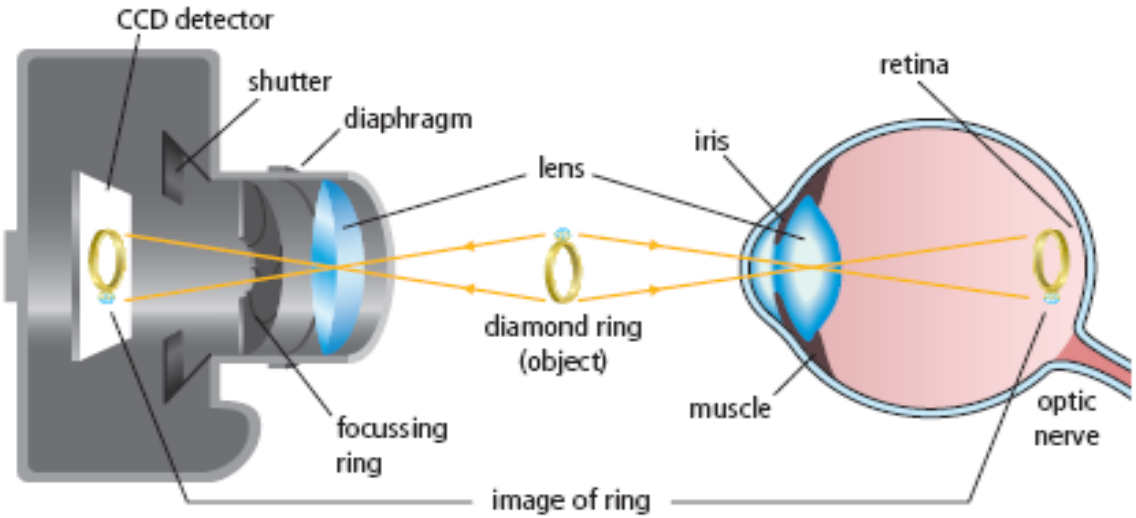
Cameras

- Light enters the camera through an opening called the aperture.
- Light then passes through a lens which focuses the image on the light detector.
- Cameras can have different types of lenses.
  - Wide-angle lens allow for a wide field of view.
  - Telephoto lenses allow distant object to appear larger.

A telephoto lens

Cameras Have Similarities to Human Eyes

Eye	Camera
Eyelid	Lens cap
Iris	Diaphragm
Retina	Charge-coupled device(CCD)
Rods and cones	pixels



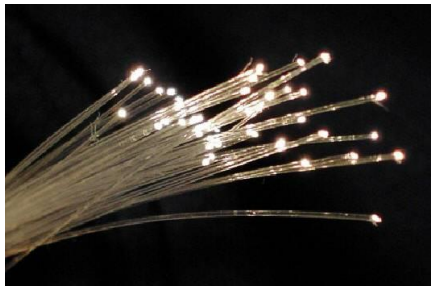
Lasers and Laser Surgery

- Laser light is light of only one wavelength.
- Can travel great distances without spreading out and contains a lot of energy.
- Lasers can be used in place of scalpels in surgery.
  - Remove cataracts
  - Reattach retina
  - Laser eye surgery to reshape the cornea.

Laser surgery

Optical Fibres

- Optical fibres are transparent glass fibres that can transmit light from one place to another.
- Optical fibres transmit light using total internal reflection.
  - Total internal reflection is when light strikes a boundary between two materials and is totally reflected.
- Optical fibres are used for:
  - Medical procedures (orthoscopic surgery)
  - Telecommunications (telephone, internet, video)



Optical fibre

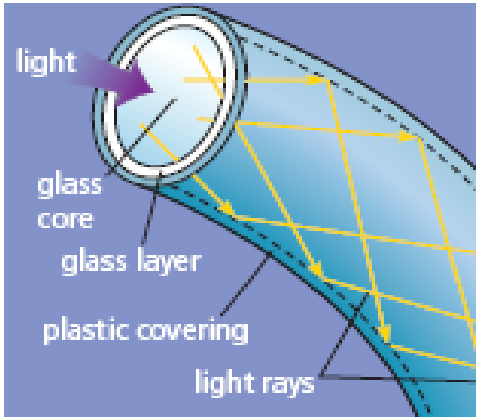


Figure 6.29 Optical fibres make use of total internal reflection.