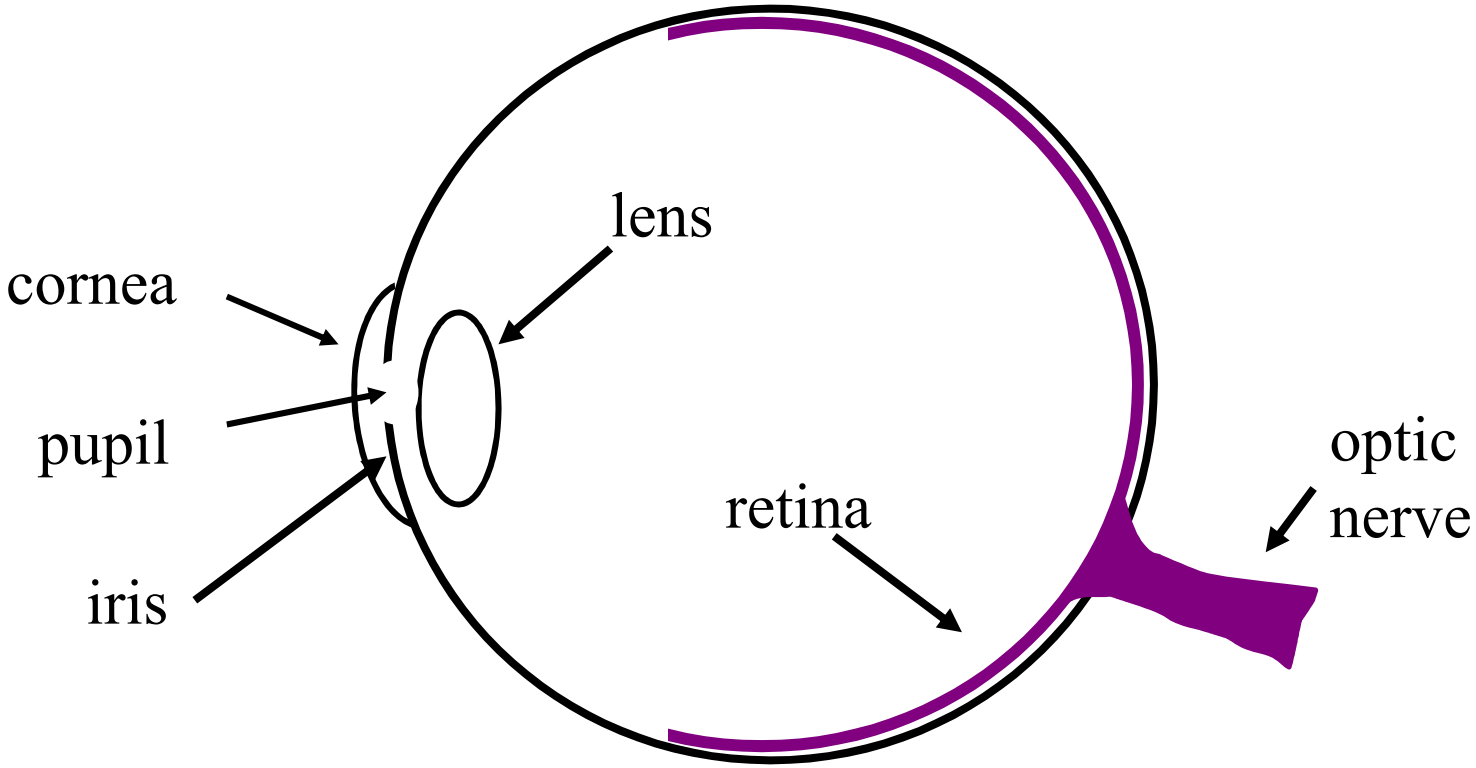
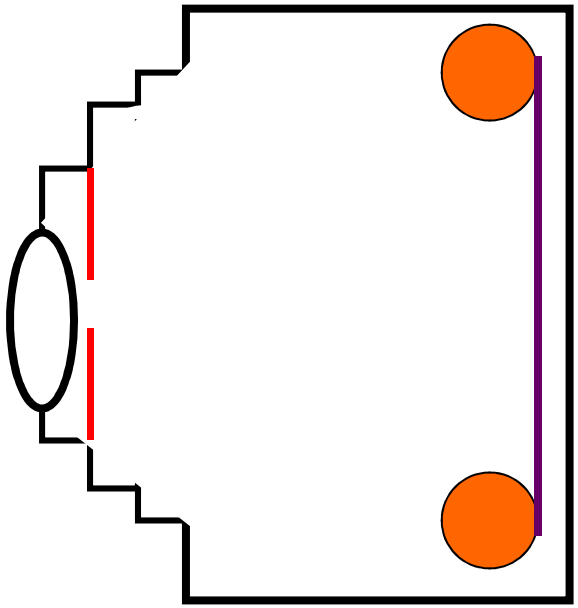
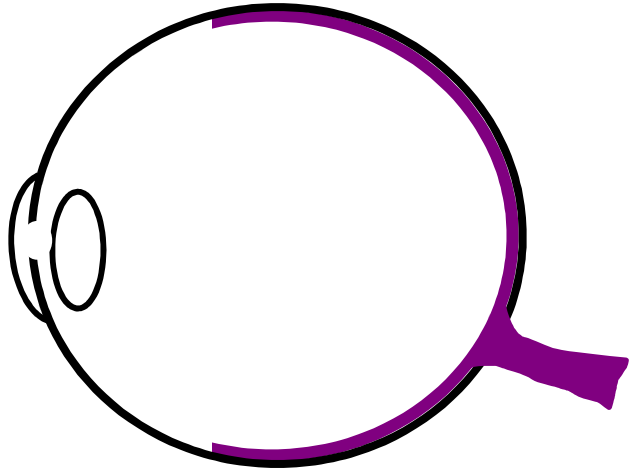
The Eye as a Camera

major elements of the eye

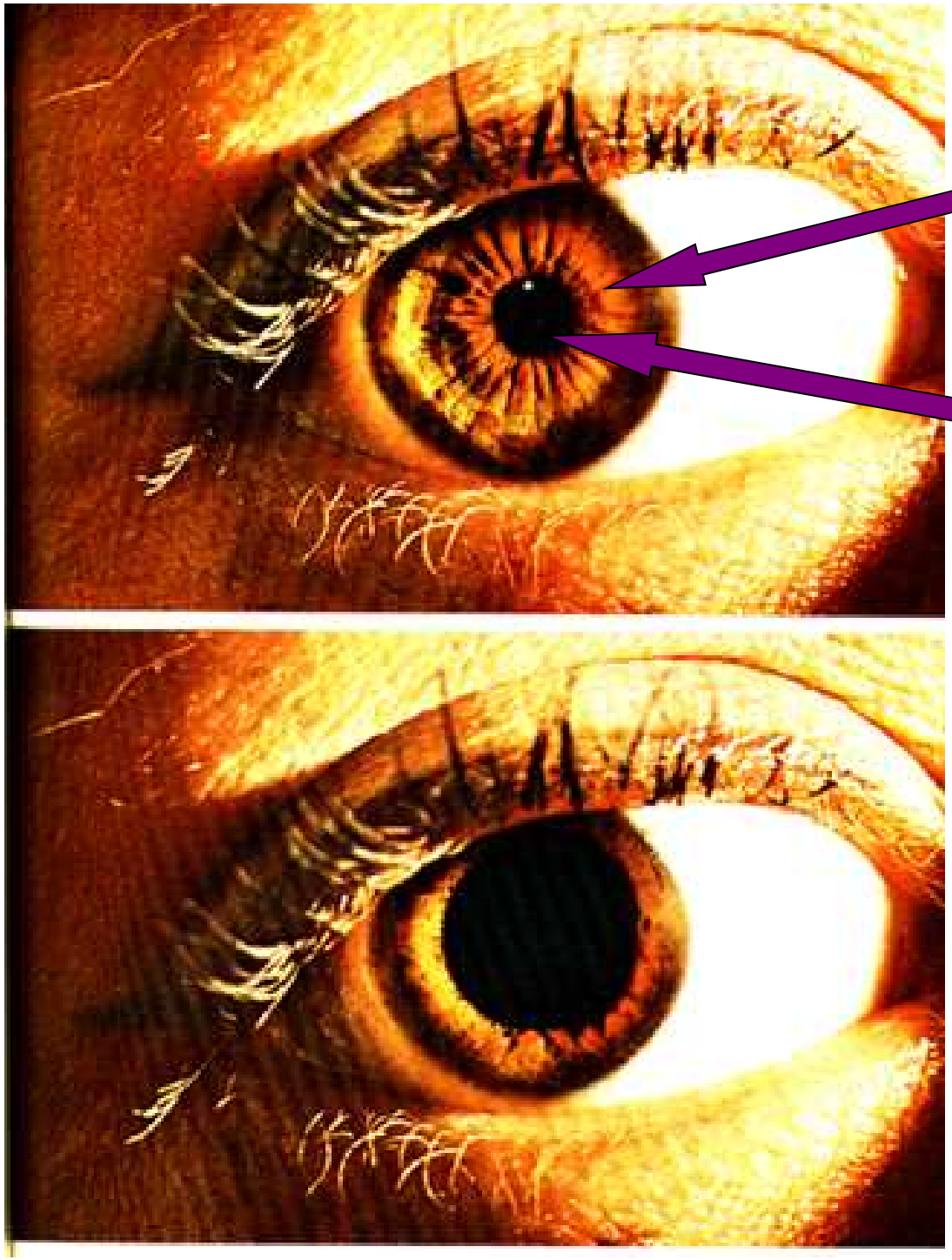


similarity of function





lens	⟷	cornea and lens
iris diaphragm	⟷	iris
film	⟷	retina



iris

pupil

The pupil opens more if more light is needed.

Why is the pupil so black?

The major function of iris is to control the amount of light entering the eye

But which camera component is essential for forming an

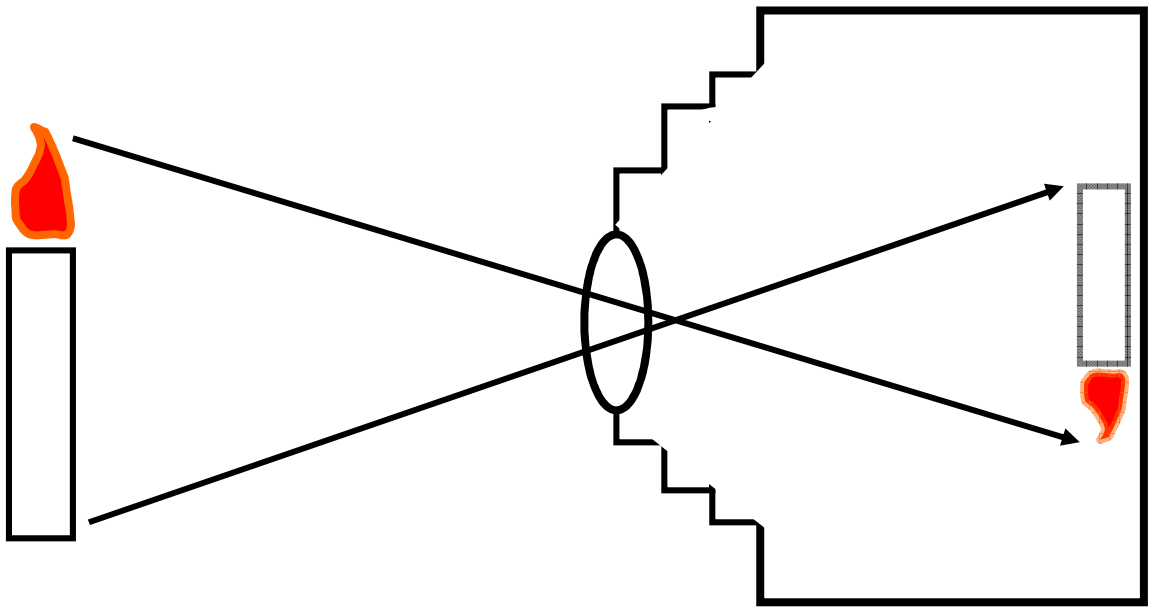
image?

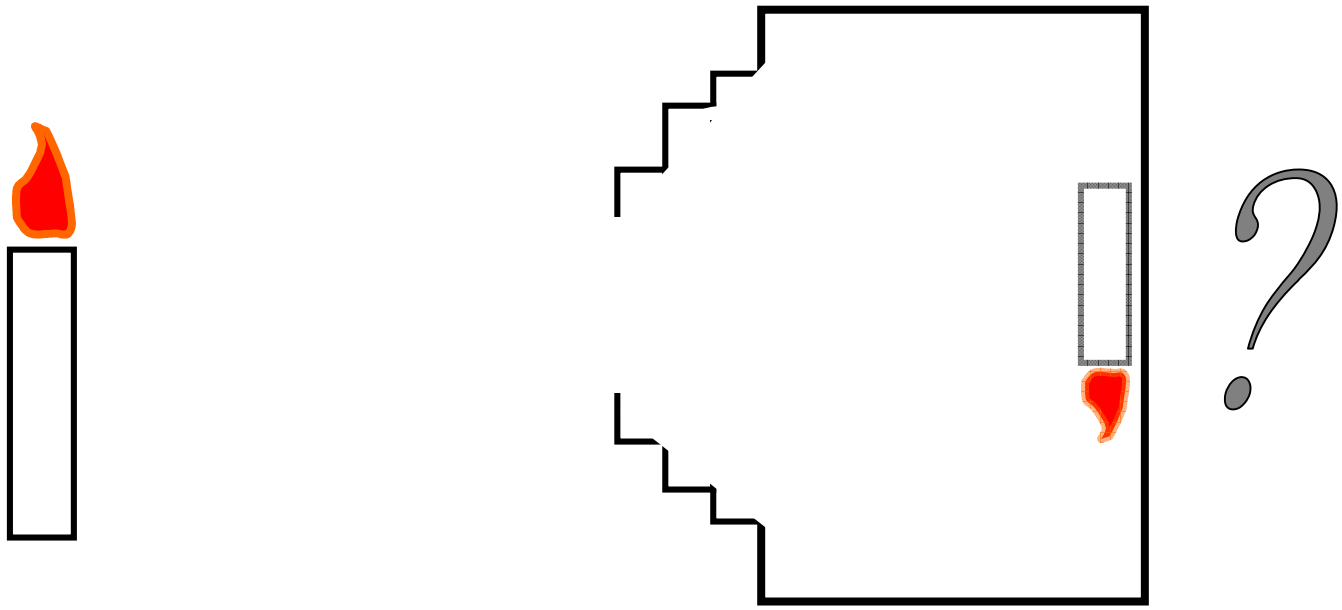
Is it the film?

Not!

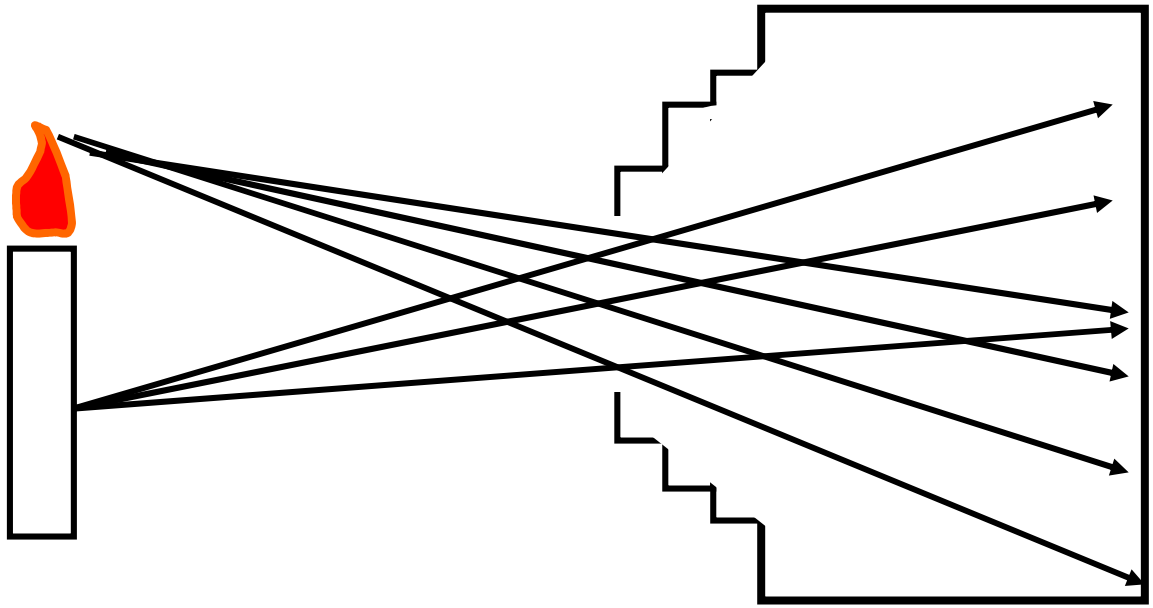
Image forming devices were used for many years as an aid to drawing -- long before the invention of film.

The important component is the lens!





Would you have an image if you got rid of the lens?



No -- because light from various parts of the object would overlap on the back of the camera.

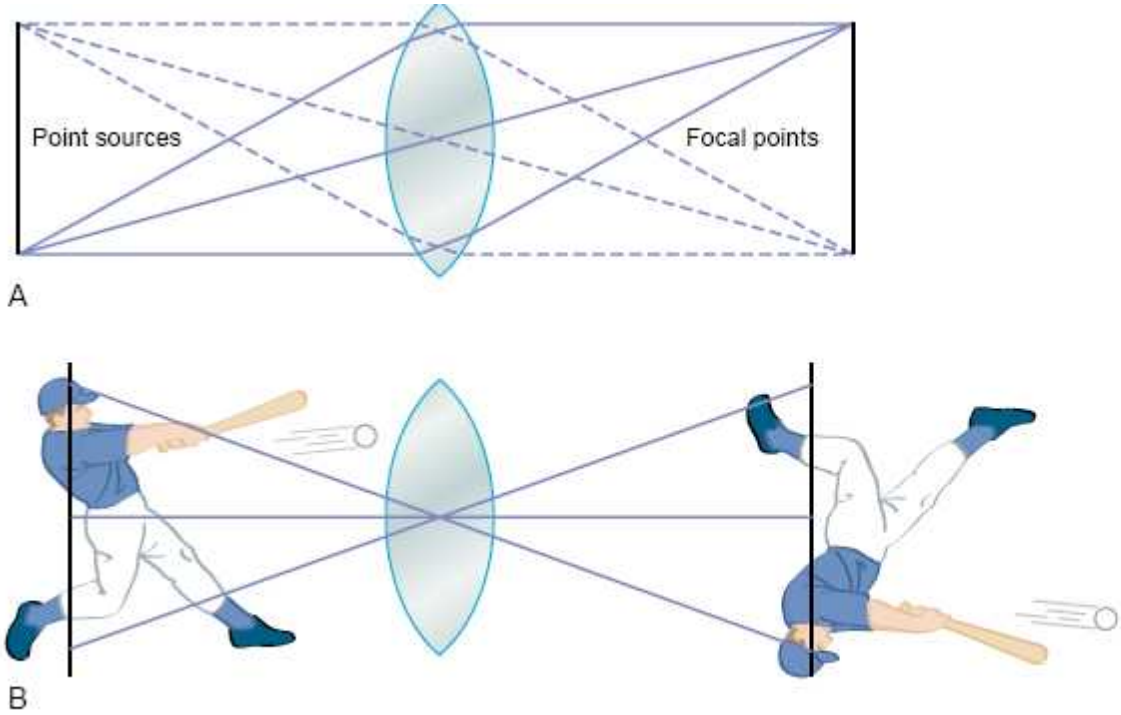
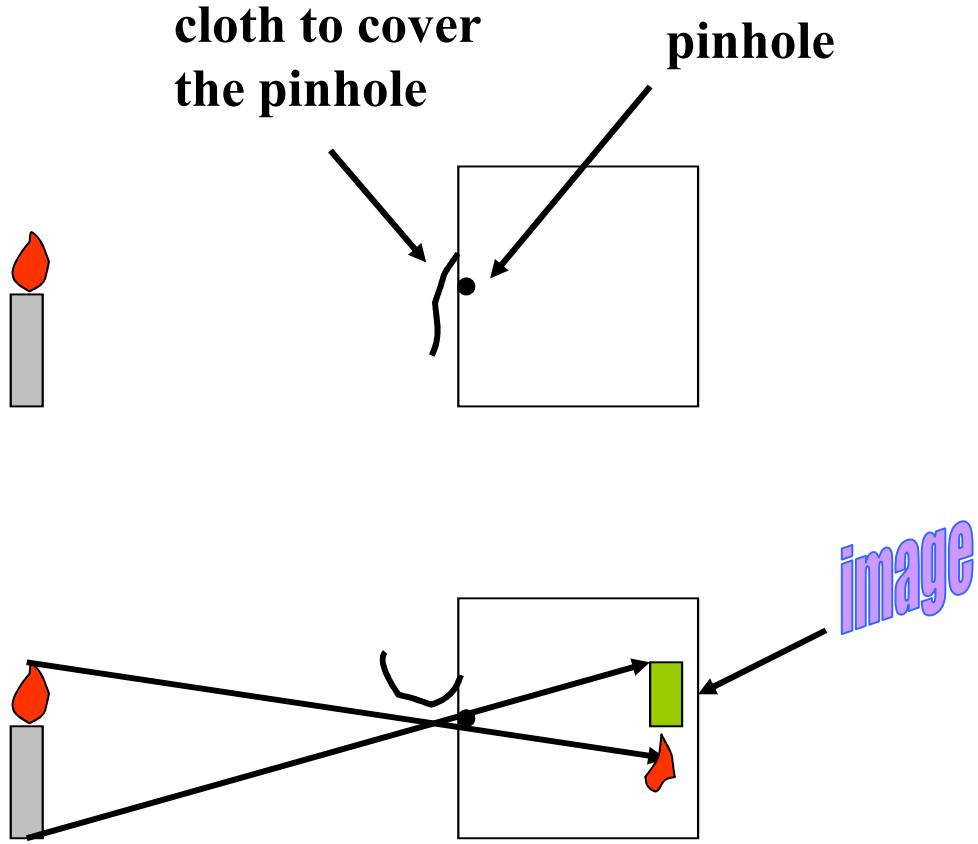
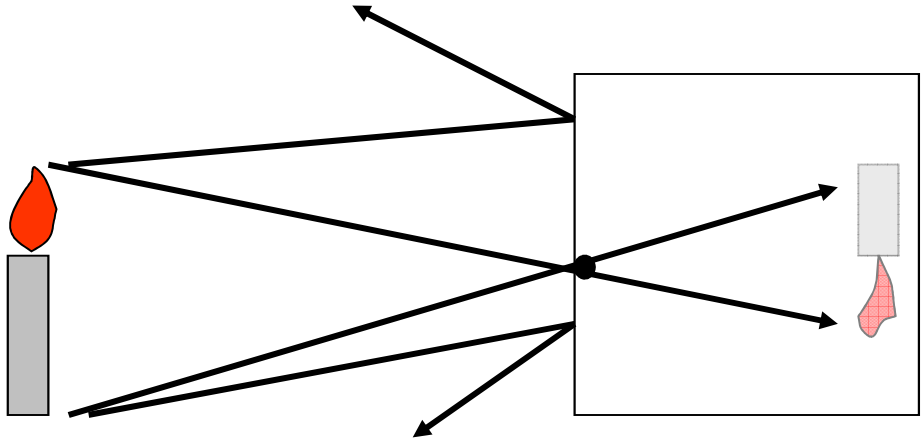


Figure 49–7

A, Two point sources of light focused at two separate points on opposite sides of the lens. *B*, Formation of an image by a convex spherical lens.

But an image can be formed without a lens if one uses a pinhole.



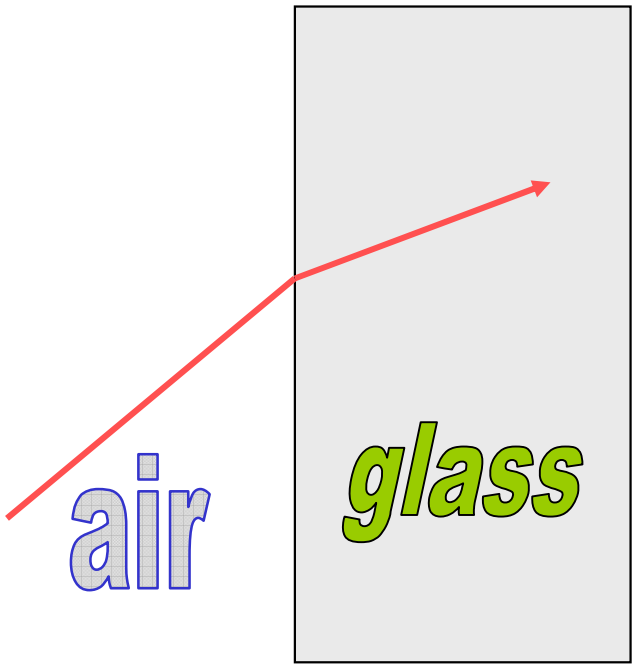


Through air, light travels in straight lines.

The pinhole only allows light from specific locations of the object to reach specific locations of the back wall of the camera.

but the image is very faint

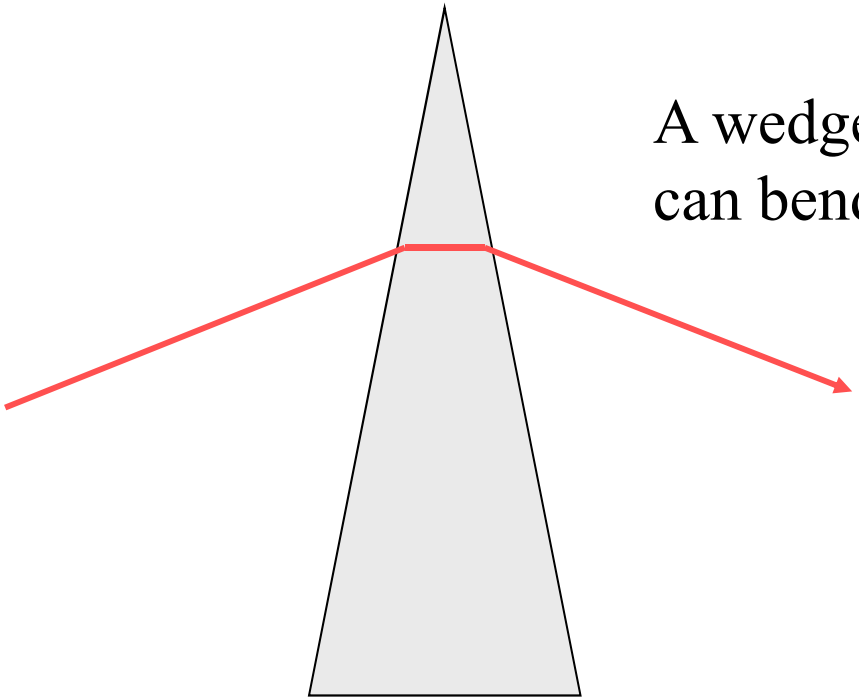
Providing the image with lots of light is the magic of the lens.



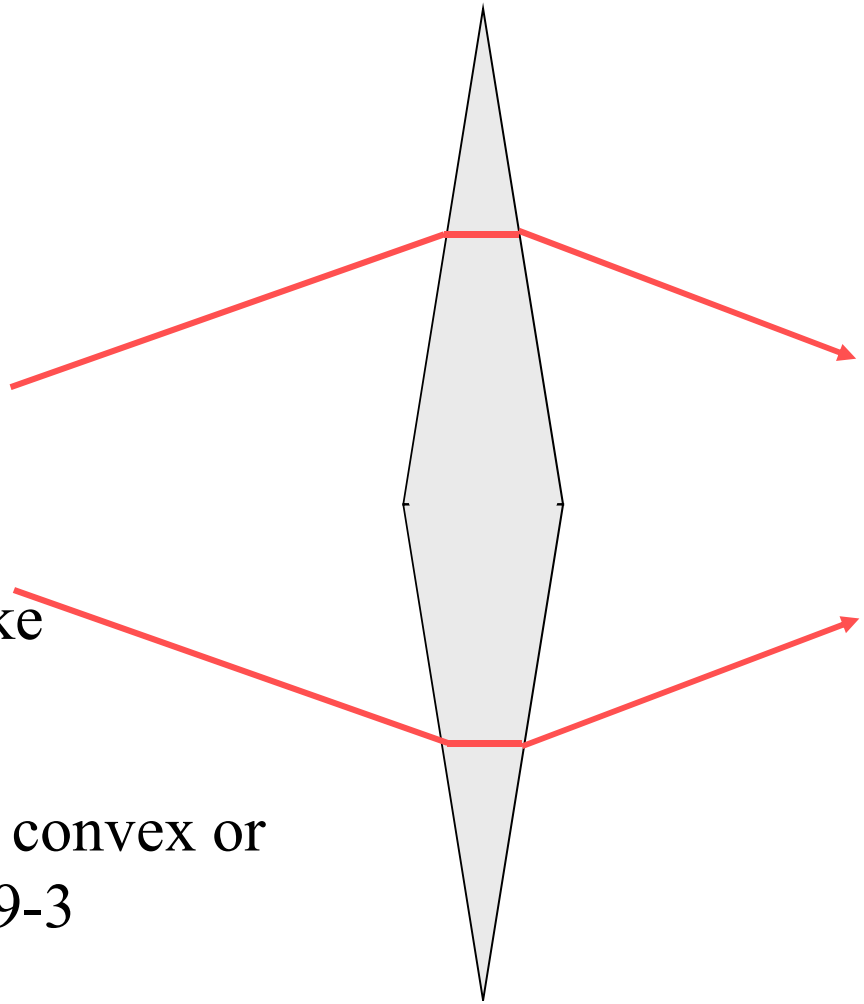
Light travels in straight lines, but will change directions when it enters (or leaves) a different medium.

This is called refraction

Refractive power is measured in terms of diopters!



A wedge of glass (prism)
can bend the light substantially...



... and a lens is like
a double prism.

What kind of lens is this, convex or
concave ? Fig. 49-2 & 49-3

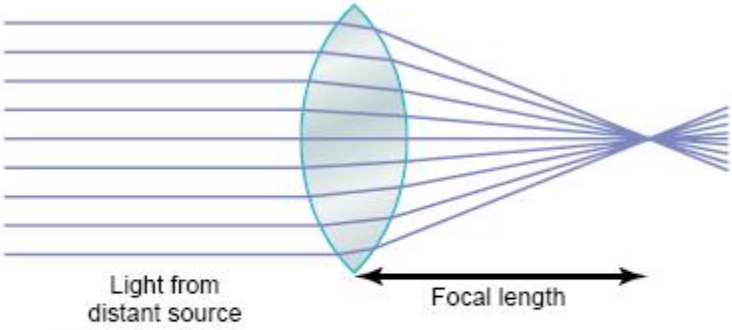


Figure 49–2

Bending of light rays at each surface of a convex spherical lens, showing that parallel light rays are focused to a *focal point*.

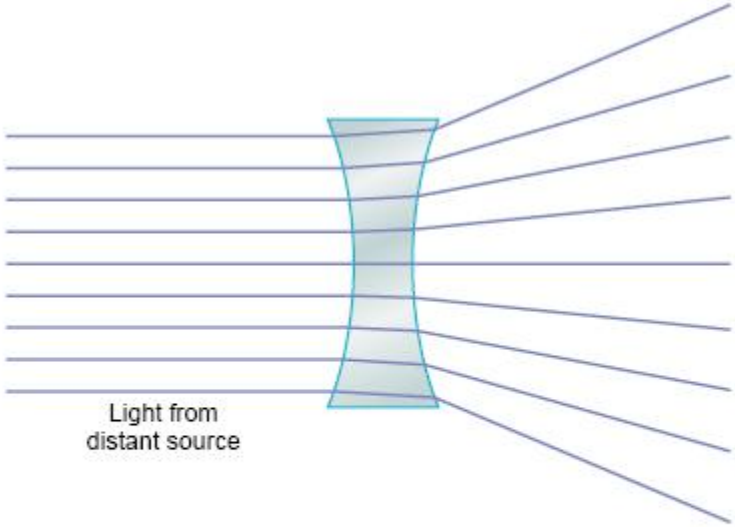
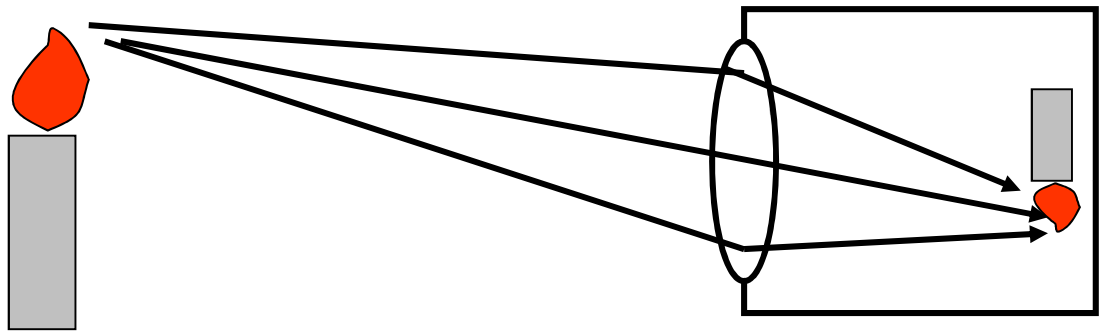


Figure 49–3

Bending of light rays at each surface of a concave spherical lens, showing that parallel light rays are *diverged*.

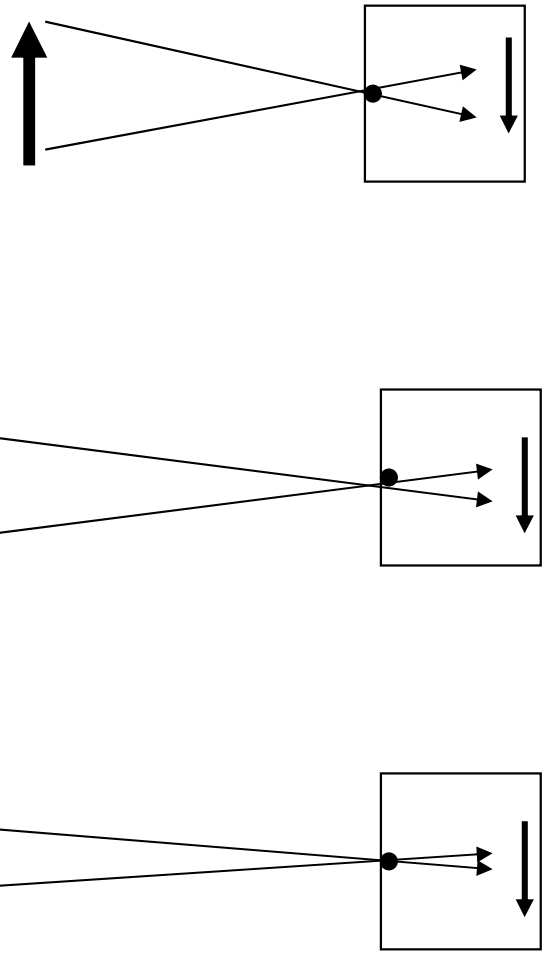
The curvature of the lens is designed to bend the light arriving from a given part of the object, so that it goes only to one location on the back wall of the camera.



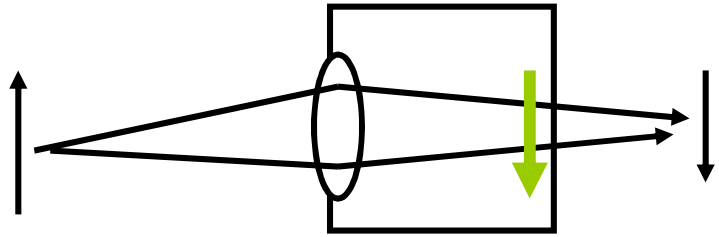
So the lens provides the image with much more light than does the pinhole.

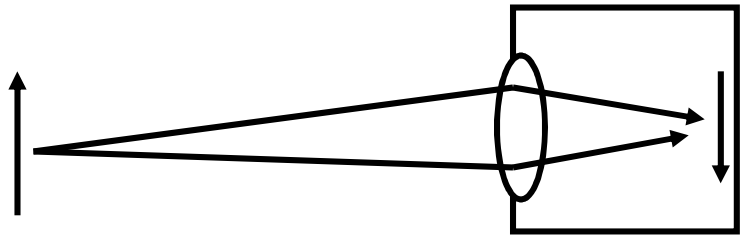
There is a cost to this magic.

With a pinhole, the image
is in sharp focus for an object
that lies at any distance.....

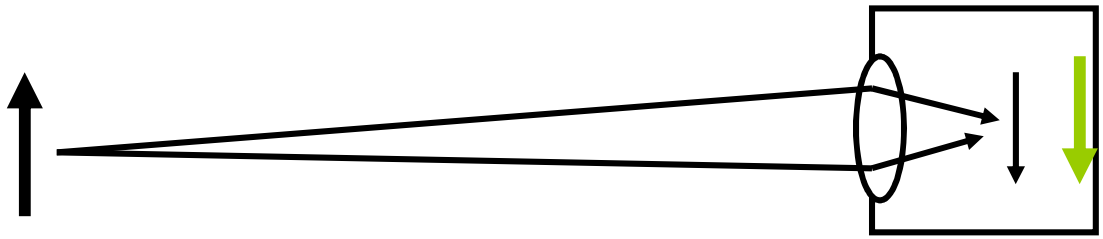


... for the lens, the location of sharp focus may not match the distance to the back of the camera.

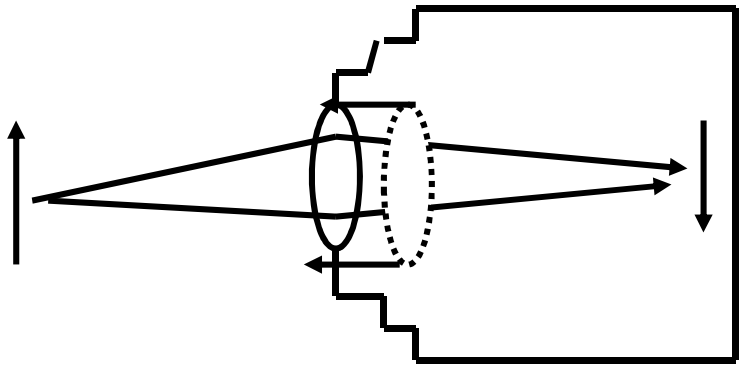




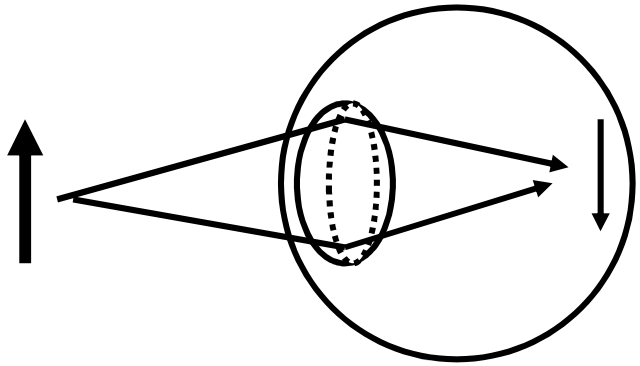
For most distances,
the image will be out of focus.



Thus, to adjust for the distance of the object, the lens of a camera is moved until the image is in focus...

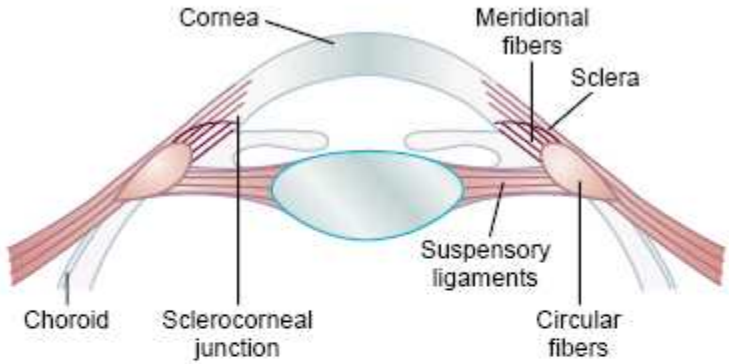


...and in the eye the shape of the lens is changed.



focusing

- Mechanism of Accommodation (focusing)
  - Fig. 49-10
  - 70 suspensory ligaments
  - Ciliary muscle
    - Meridional fibers
    - Circular fibers
  - Stimulation of parasympathetic nerves contracts the ciliary muscle



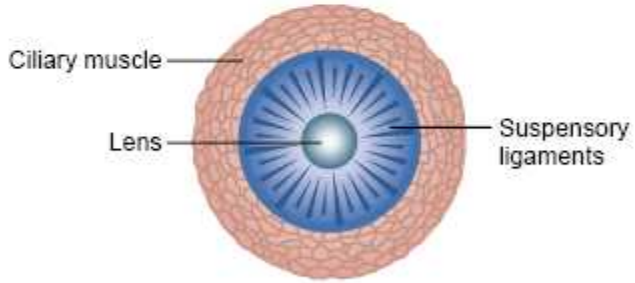


Figure 49–10

Mechanism of accommodation (focusing).