

Light Insight

! Facts to remember

- ▶ Human eyes are categorised as 'simple' eyes.
- ▶ In order to “see” (light to focus on the retina) light needs to travel from one refractive index into another (air to lens).
- ▶ The lens of the human eye has a refractive index close to that of water ($n = 1,38 - 1,39$).
- ▶ The eye has seven important parts; **eyelids, cornea, iris, pupil, lens, retina and the optic nerve.**
- ▶ One main difference between the human eye and a camera is that a camera focusses on objects by changing the distance between the lens and the film whereas the eye changes the shape of its lens.
- ▶ The cornea allows the lens in the eye to change its shape and focal length . This is called **accommodation.**
- ▶ The power of the eye (lens) is measured in dioptres and is $1/\text{focal length}$. This is also how the power of corrective lenses is measured.

When the eyes are not so accommodating...

A lot of people wear spectacles or contact lenses to correct their vision. As you saw in the worksheet, the lens in their eyes cannot “accommodate” enough to form a clear image. Short sightedness is called **myopia**. This is when the eye forms an image in front of the retina instead of on it because the lens in the eye cannot become flat enough to focus far away objects. *Concave lenses are used to correct short sight.* Long sightedness is called **hyper-metropia or hyperopia** and the image forms behind the retina because the lens cannot become round enough to focus nearby objects. *Convex lenses are used to correct long sight.* **Astigmatism** is when the cornea or the lens in the eye is not perfectly spherical. This causes the different light rays entering the eye to focus at different points and one sees a blurred image. Astigmatism can be corrected with spectacles and contact lenses. These days laser eye surgery is becoming a popular way to correct vision.

Seeing underwater and beyond...

Of course, sight is not limited just to people. We are able to see because light travels from the air outside our eyes, refracts and is focused by our lens. Many animals have highly sensitive eyesight and some even underwater! But how does a fish see underwater? The first thing to realise is that fish don't see the way we do. Their lenses are perfectly spherical, which enables them to see underwater because it has a higher refractive index ($n = 1.65$) to help them focus. They focus by moving the lens in and out instead of stretching it like we do. They cannot expand or contract their pupils because the lens bulges through the iris. For fish that live deeper in the ocean, the fish's eye size increases in order to gather the dimmer light. **Fish eye lenses are popular in cameras today** and the photos they take are something like this. This gives you an idea of how the world looks to a fish underwater!



Photograph of the European Southern Observatory's Very Large Telescope taken with a fisheye lens. (ESO/José Francisco Salgado (josefrancisco.org))