BBC BITESIZE

Hello, I'm Dr Alex Lathbridge and this is Bitesize Biology.

This is the sixth episode in our series on homeostasis. Today, we're going to talk about the brain and the eyes.

I mentioned the brain in our episode on the Nervous System. It is part of our central nervous system along with the spinal cord.

It is made of billions interconnected nerve cells, called neurones, that carry electrical impulses.

The brain is responsible for complex behaviour, and stupid behaviour too.

Scientists have mapped different regions of the brain and have been able to find out what they do, in terms of controlling our functions and behaviours.

You will need to learn the names of three parts and what they control:

The cerebral cortex. That's the outer layer of the brain and is divided into two hemispheres. It is responsible for memory, consciousness and personality.

The cerebellum. This is underneath the cerebral cortex and controls balance, co-ordination of movement and muscular activity.

The medulla. This is a long, stem-like structure in the bottom part of the brainstem. It controls unconscious activities like heart rate and breathing rate

So that's the cerebral cortex, cerebellum and medulla. Obviously there's a lot more going on in the brain than that, but that's all you need to know for now.

So now let's focus on the eyes. What is the eye, biologically speaking?

The eye is a sensory organ, containing receptors.

The eye receptors are sensitive to changes in light intensity and colour.

The eye contains two types of receptors: rod cells which are sensitive to light intensity and cone cells which are sensitive to colour.

All of the structures of the eye function together, to allow light to hit an area called the retina, which sends signals to the brain, processing that as vision.

You need to know the names of these different structures of the eye and their functions so it might be a good idea to grab a pen and draw your own eye diagram.

The cornea. This is a transparent lens in front of the eye, it refracts light as it enters the eye. This just means it bends it.

The iris. This controls how much light enters the pupil.

The lens is transparent disc that further refracts light to focus it onto the retina.

The retina contains receptor cells. These are the rod cells to detect light intensity and the cone cells to detect colour.

The optic nerve is a bundle of neurones that carries impulses from the eye to the brain.

The sclera is a tough white, outer layer of the eye, it helps protect your eye from injury.

You can check your own eye diagram against the ones found on the Bitesize website.

Unlike a digital camera where you can control the amount of light entering through the lens, the amount of light entering the eye is controlled by reflex action. You don't control it by thinking.

This happens by the size of pupil changing automatically in response to either bright or dim light.

This is controlled by the muscles of the iris.

When there is bright light, this reflex action prevents the retina from damage.

When there is dim light (when its dark), this reflex action protects us from not being able to see anything.

Go in front of a mirror, turn the light off for about 10 to 15 seconds, and then turn it back on. If you're fast, you'll be able to catch your pupil going from very dilated to very constricted.

This reflex action is controlled by two groups of muscles in the iris:

The radial muscles and the circular muscles.

They do different things in dim light or bright light

In dim light the pupil dilates (gets bigger) to allow as much light into the eye as possible.

If it's dark, you want to make sure you can really capture all of the light so in dim light, the receptors detect changes in the environment and the radial muscles contract.

The circular muscles relax and the pupil dilates so that more light can enter the eye, making it easier for us to see in dark environments.

So in bright light, receptors detect changes in the environment and the radial muscles relax, the circular muscles contract, and the pupil constricts so that less light can enter the eye, protecting the retina from damage.

You really don't want your retina to burn out, this why you don't stare directly into the sun or the direct path of a laser.

Accommodation is the process of the lens changing shape in order to focus on near or faraway objects.

The lens is elastic and the suspensory ligaments attached to it become tighter or looser, and this changes the shape of the lens in the process.

The ciliary muscles either relax or contract depending on how near or faraway an object is.

In order to focus on a near object :

The ciliary muscles contract

The suspensory ligaments loosen

The lens becomes thicker and refracts light rays more intensely.

But, to focus on a faraway, distant object:

The ciliary muscles relax

The suspensory ligaments tighten

The lens becomes thinner and refracts less light

Myopia is the scientific name for short-sightedness, and hyperopia is the name for long-sightedness.

In both myopia and hyperopia, rays of light do not focus properly on the retina, and that means that a person's vision is not a clear image. So what do people do ?

People wear glasses, with lenses which refract the rays of light to compensate, so that the rays of light do focus on the retina properly.

Myopia, short-sightedness, can be corrected by using a concave lens (bending in.)

Hyperopia, long-sightedness, is corrected by glasses using a convex lens.

I'm Dr Alex Lathbridge and this is Bitesize Biology. All episodes available right now on BBC Sounds.