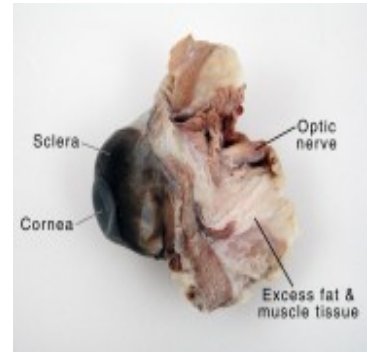


## STUDY OF THE Cow Eye

A cow eye is very similar to the eye of a human. By dissecting and examining the anatomy of a preserved cow eye, you can learn how your own eye forms images of the world around you and sends these images to your brain. This dissection guide is complete enough for a high school lab, or it can be used to get an idea of what the eye looks like.

### Observation: External Anatomy

Look carefully at the [preserved cow eye](#). The most noticeable part of the eye is the large mass of gray tissue that surrounds the **posterior** (back) of the eye and is attached to the **sclera**. The second most noticeable part of the eye is the **cornea**, located in the **anterior** (front) part of the eye. Due to the fact that the eye has been preserved, the cornea is cloudy and bluish-gray in color. It may also be wrinkly and seem a bit "deflated". On the posterior side of the eye, nestled in the fat and muscle tissue, there is a noticeably round protuberance that feels stiffer than the surrounding tissue. This is the **optic nerve**, and it sends the images collected in the eye to the brain.



### Dissection: Internal Anatomy

1. Place the cow eye on a [dissecting tray](#). The eye most likely has a thick covering of fat and muscle tissue. Carefully cut away the fat and the muscle. As you get closer to the actual eyeball, you may notice muscles that are attached directly to the **sclera** and along the optic nerve. These are the **extrinsic muscles** that allow a cow to move its eye up and down and from side to side. Keep cutting close to the sclera, separating the membrane that attaches the muscle to it. After removing the excess tissue, the sclera and optic nerve should be exposed but still intact.

2. Using a sharp [scalpel](#), cut through the sclera around the middle of the eye so that one half will have the anterior features of the eye (the cornea, lens, iris, and ciliary body) and the other half will contain the posterior features (most noticeably where the optic nerve is attached to the eye). The inside of the eye cavity is filled with a clear, gelatinous liquid. This is the **vitreous humor**, and it helps maintain the shape of the eye. Carefully remove and discard this gelatinous material.

3. Flip the anterior half of the eye over so that the front of it is facing upward. Using a pair of sharp [scissors](#), cut the **cornea** from the eye along the boundary where the cornea meets the sclera. When the scissors have cut in far enough, a clear fluid will start to seep out - this is the **aqueous humor**. While cutting out the cornea, be careful to not accidentally cut the iris or the lens. After removing the cornea, pick it up and look through it. Although it is cloudy due to the degrading of the tissue, it is still fairly transparent. Notice the toughness and strength of the cornea. It is designed this way to protect the more delicate features found inside the eye.



4. With the front of the anterior half of the eye facing up, locate the **iris**. Notice how the iris is positioned so that it surrounds and overlaps the lens. This position allows the iris to open and close around the lens to allow different amounts of light into the eye. In bright light, the iris contracts to let in less light. In dim light, such as at night, the iris expands to let in more light.

5. Flip the anterior half over and examine the back half. Locate the lens and **ciliary body**. The ciliary body surrounds the lens, allowing it to change the shape of the lens to help the eye focus on the object it is viewing.

6. After examining both sides of the anterior half of the eye, pull the **lens** out. While the cow was alive, the lens was clear and very flexible. In a preserved cow eye, the lens will most likely have yellowed and become very hard. However, it may still be possible to look through the lens and see its ability to magnify objects. Try this by placing the lens on a piece of paper with writing on it.

7. On the posterior half of the eye, there is a thin, tissue-like material that slides easily inside the sclera. This is the **retina**. The retina contains photoreceptor cells that collect the light entering the eye through the lens from the outside world. These images are sent to the optic disc, the spot where the optic nerve attaches to the eye. At this point, there are no photoreceptor cells; there are only nerves sending images to the brain. Because of this, this place in the eye is often referred to as the **blind spot** since no images can be formed here. To compensate for this blind spot, the other eye often sees the images that the first eye cannot see and vice versa. In the rare occasions where neither eye can see a particular spot, the brain "fills in" the spot using the surrounding background information it receives from the eye. However, the "filling in" of the blind spot is not always accurate. This accounts for the phenomenon when a driver thinks that all was clear after using a rearview mirror to check for cars when in reality a car was there but not seen because the brain "filled in" the background incorrectly.

8. Most of the retina is not attached to the eye. Instead, it is held in place by the vitreous humor which presses the retina flat against the inside of the eye. The tissue of the retina gathers at the back of the eye where it forms into the optic nerve. This is the only place where the retina is attached to the eye. Use a pair of tweezers to gently lift the retina off the inside wall of the eye. The retina may tear because it is very delicate. Underneath the retina you will find a very shiny and colorful tissue. This is the **choroid coat**. The choroid coat is also known as the vascular tunic because it supplies the eye with blood and nutrients. In a human eye, the choroid coat is very darkly colored to minimize the reflection of light which would cause distorted images.

9. Notice that the choroid coat in the cow's eye is very colorful and shiny. This reflective material is the **tapetum lucidum**, and its reflective properties allow a cow to see at night by reflecting the light that is absorbed through the retina back into the retina. (While this does allow the cow to see better at night than humans can, it distorts the clarity of what the cow sees because the light is reflected so much.) The tapetum lucidum is also responsible for the "glowing" eyes of animals, such as cats, when a small amount of light reflects off the tapetum lucidum in an otherwise dark room.

