COW'S EYE dissection



Dissecting a Cow's Eye
Step-by-Step Instructions

One way to figure out how something works is to look inside it. To learn about how your eyes work, you can *dissect*, or take apart, a cow's eye.

Safety first!

You'll be using a scalpel or a razor to cut the cow's eye. Be careful. A scalpel or razor can cut you as easily as it cuts the cow's eye.

Whenever you handle raw meat (whether it's a cow's eye or a steak), you wash your hands thoroughly afterward to wash away any bacteria you picked up from the meat. If you have cuts on your hand, we also recommend you wear gloves so that no bacteria from the cow's eye infects your cut.

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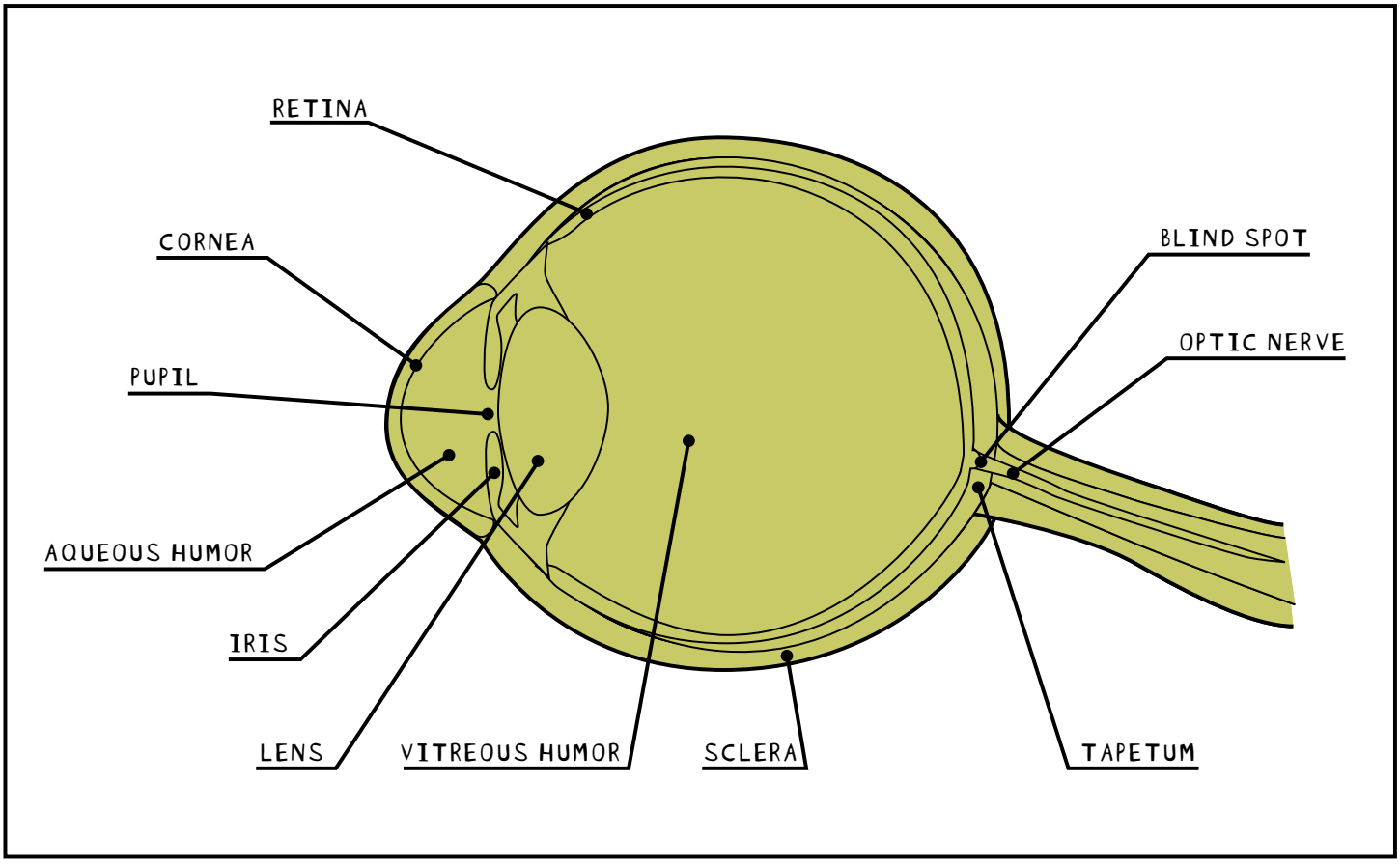
Visit the Cow's Eye Dissection online:
http://www.exploratorium.edu/coweye

Here's what you need:

- One cow's eye for every two participants
- One single-edged razor blade or scalpel for every two participants
- Scissors (optional)
- Wax paper and paper towels
- Plastic garbage bag
- A cutting board or other surface on which you can cut
- A sheet of newspaper
- Soap, water, and paper towels for cleaning up

Here's where to get cows' eyes:

You can order cows' eyes at a butcher shop or purchase them directly from a slaughterhouse. Try to get eyes with the muscles and fat still attached. If possible pick up the cows' eyes the day of the dissection; eyes are easier to cut when they are fresh.

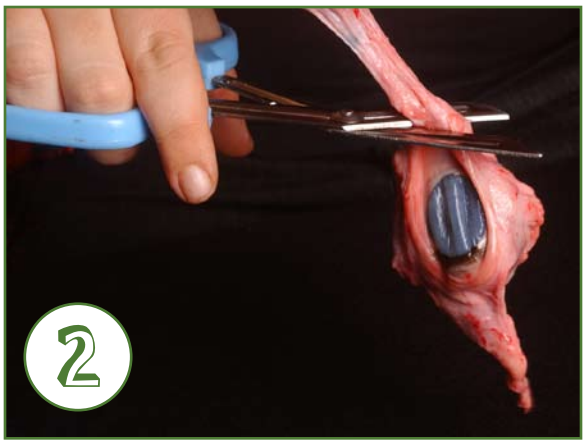


This diagram shows the parts of the eye. Can you find these parts in a cow's eye?

Here's what you do:



Examine the outside of the eye. See how many parts of the eye you can identify. You should be able to find the whites (or ***sclera***), the tough, outer covering of the eyeball. You should also be able to identify the fat and muscle surrounding the eye. You should be able to find the covering over the front of the eye (the ***cornea***). When the cow was alive, the cornea was clear. In your cow's eye, the cornea may be cloudy. You may be able to look through the cornea and see the ***iris***, the colored part of the eye, and the ***pupil***, the dark oval in the middle of the iris.



Cut away the fat and muscle.



Use a scalpel to make an incision in the cornea. (Careful—Don't cut yourself!) Cut until the clear liquid under the cornea is released. That clear liquid is the ***aqueous humor***. It's made of mostly of water and keeps the shape of the cornea.



Use the scalpel to make an incision through the ***sclera*** in the middle of the eye.



Use your scissors to cut around the middle of the eye, cutting the eye in half. You'll end up with two halves. On the front half will be the ***cornea***.

The cornea is made of pretty tough stuff—it helps protect your eye. It also helps you see by bending the light that comes into your eye.

Once you have removed the cornea, place it on the board (or cutting surface) and cut it with your scalpel or razor. Listen. Hear the crunch? That's the sound of the scalpel crunching through layers of clear tissue. The cow's cornea has many layers to make it thick and strong. When the cow is grazing, blades of grass may poke the cow's eye—but the cornea protects the inner eye.



The next step is to pull out the ***iris***. The iris is between the ***cornea*** and the ***lens***. It may be stuck to the cornea or it may have stayed with the back of the eye. Find the iris and pull it out. It should come out in one piece. You can see that there's a hole in the center of the iris. That's the ***pupil***, the hole that lets light into the eye. The iris contracts or expands to change the size of the pupil. In dim light, the pupil opens wide to let light in. In bright light, the pupil shuts down to block light out.

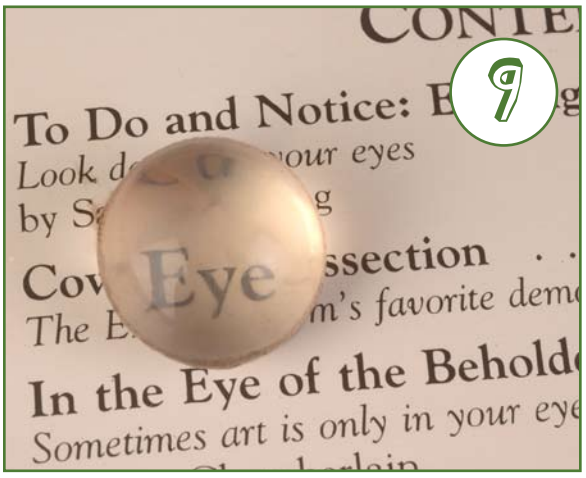


The back of the eye is filled with a clear jelly. That's the ***vitreous humor***, a mixture of protein and water. It's clear so light can pass through it. It also helps the eyeball maintain its shape.

Now you want to remove the ***lens***. It's a clear lump about the size and shape of a squashed marble.



The ***lens*** of the cow's eye feels soft on the outside and hard in the middle. Hold the lens up and look through it. What do you see?



Put the ***lens*** down on a newspaper and look through it at the words on the page. What do you see?



Now take a look at the rest of the eye. If the ***vitreous humor*** is still in the eyeball, empty it out. On the inside of the back half of the eyeball, you can see some blood vessels that are part of a thin fleshy film. That film is the ***retina***. Before you cut the eye open, the vitreous humor pushed against the retina so that it lay flat on the back of the eye. It may be all pushed together in a wad now.

The retina is made of cells that can detect light. The eye's ***lens*** uses the light that comes into the eye to make an image, a picture made of light. That image lands on the retina. The cells of the retina react to the light that falls on them and send messages to the brain.



Use your finger to push the retina around. The retina is attached to the back of the eye at just one spot. Can you find that spot? That's the place where nerves from all the cells in the retina come together. All these nerves go out the back of the eye, forming the ***optic nerve***, the bundle of nerves that carries messages from the eye to the brain. The brain uses information from the retina to make a mental picture of the world.

The spot where the retina is attached to the back of the eye is called the ***blind spot***. Because there are no light-sensitive cells at that spot, you can't see anything that lands in that place on the retina.



Under the retina, the back of the eye is covered with shiny, blue-green stuff. This is the ***tapetum***. It reflects light from the back of the eye.

Have you ever seen a cat's eyes shining in the headlights of a car? Cats, like cows, have a tapetum. A cat's eye seems to glow because the cat's tapetum is reflecting light. If you shine a light at a cow at night, the cow's eyes will shine with a blue-green light because the light reflects from the tapetum.



Look at the other side of the back of the eye. Can you find the ***optic nerve***? To see the separate fibers that make up the optic nerve, pinch the nerve with a pair of scissors or your fingers. If you squeeze the optic nerve, you may get some white goop. That is myelin, the fatty layer that surrounds each fiber of the nerve.

Clean-up

When you're done dissecting the cow's eye, wrap all the pieces of the eye in plastic and throw them away. If you used a razor blade, dispose of it properly. A razor blade is only good for one or two dissections.

Glossary

aqueous humor
A clear fluid that helps the cornea keep its rounded shape.

blind spot
The place where all nerves from the retina join to form the optic nerve. Each eye has a blind spot where there are no light-sensitive cells.

cones
One kind of light-sensitive cell in the retina. Cones give you color vision in bright light.

cornea
A tough, clear covering over the iris and the pupil that helps protect the eye. Light bends as it passes through the cornea. The cornea begins bending light to make an image; the lens finishes the job.

iris
A muscle that controls how much light enters the eye. It is suspended between the cornea and the lens. A cow's iris is brown. Human irises come in many colors, including brown, blue, green, and gray.

lens
A clear, flexible structure that makes an image on the eye's retina. The lens is flexible so that it can change shape, focusing on objects that are close up and objects that are far away.

myelin
The fatty layer that surrounds each nerve fiber.

optic nerve
The bundle of nerve fibers that carry information from the retina to the brain.

pupil
The pupil is the dark circle in the center of your iris. It's a hole that lets light into the inner eye. Your pupil is round. A cow's pupil is oval.

retina
The layer of light-sensitive cells at the back of the eye. The retina detects images focused by the cornea and the lens. The retina is connected to the brain by the optic nerve.

rods
One kind of light-sensitive cell in the retina. Rods respond in dim light.

sclera
The thick, tough, white outer covering of the eyeball.

tapetum
The colorful, shiny material located behind the retina. Found in animals with good night vision, the tapetum reflects light back through the retina.

vitreous humor
The thick, clear jelly that helps give the eyeball its shape.