Introduction:
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.

Materials:
- Dissection tray
- Scalpel
- Dissection scissors
- Dissection Probe
- Tray of water
- Safety equipment (gloves and goggles)

Observation: External Anatomy – Day 1

Look carefully at the preserved cow eye (figure 1). The most noticeable part of the eye is the large mass of gray tissue that surrounds the posterior of the eye and is attached to the sclera. The second most noticeable part of the eye is the cornea, located in the anterior 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".

NOTE: Fat tissue will be white in color and Muscle tissue will be red/pink in color.

Procedure: Day 1

1.) 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.

2.) Next, focus on cleaning up the exterior parts of the eye. Remove any unwanted fat (adipose tissue) from the surface of the eye and observe the muscles that surround the eye. 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.

3.) **DRAW AND LABEL**: In the boxes below draw and label the Posterior and Anterior views of the eye to scale. (4 points each)
**Name: ________________________________**

**Dissection: Internal Anatomy – Day 2**

**Procedure:**

1. 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 and the other half will contain the posterior (see figure 2). The inside of the eye cavity is filled with liquid. This is the **vitreous humor**, and it helps maintain the shape of the eye. Depending on how the specimen was preserved, it will be either a dark liquid that will flow out easily, or a slightly gelatinous material that you can pour out to remove. Once you separate the two halves place the posterior half in the water in your tray for later observation.

2. 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!!** (figure 3)

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. Describe what the cornea feels like on the lines below:

**Description of the Cornea:** (2 points)

________________________________________________________________
________________________________________________________________
________________________________________________________________
________________________________________________________________

3. With the front of the anterior half of the eye facing up, locate the **iris**, a type of sphincter muscle (circular contraction). 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. The “hole” that the iris makes, which allows light in to the eye, is called the **pupil**.

5. Flip the anterior half over and examine the back half. Locate the lens and **ciliary body**. The ciliary body surrounds the lens and is a muscle that allows the eye to change the shape of the lens to help focus on the object that is being viewing.

6. After examining both sides of the anterior half of the eye, remove the **lens** out by cutting the ciliary body with your scissors. Rinse with the water in your tray and pat dry with a paper towel. 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 the box below and see if it magnifies the image.

7. Next take the lens and, using your scalpel, divide it in half. **In the box to the right draw your observation.** (3 points)

8. **Observe the posterior half you placed in the water earlier.** On the posterior half of the eye, there is a thin, tissue-like material that slides easily inside the sclera. This is the **retina** (see figure 4). 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.

9. 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. On the line below describe the appearance and feel of the retina:

Retina: (2 points)
__________________________________________________________________________
__________________________________________________________________________

10. Notice that the choroid coat in the cow’s eye is very colorful and shiny. This reflective material is the tapetum lucidum (phonetically: tape-e-tum lucy-dum), 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 (We call this phenomenon “Red eye”), such as cats, when a small amount of light reflects off the tapetum lucidum in an otherwise dark room.

11. Take all biological waste to the trash receptacle in the front of the classroom ONLY. All of your group’s materials should be washed and dried THROUGHLY and THEN placed back in the way you found them.

Post Lab questions: (4 points each)
Please answer on a separate sheet. NO CREDIT will be given if answers are written on this paper

SHS Problem solving Rubric will be used to grade this lab and questions...

1.) What is the most interesting feature or structure of the bovine eye that you dissected today?

2.) How would you think the eye would differ in a human?

3.) How about in an aquatic organism, like a tuna? How do you think the eye would be different?

4.) How would you be affected if your iris was removed from your eye? How would this affect your vision?

5.) If a nocturnal animal was born with a genetic mutation where the tapetum lucidum did not form correctly how would this affect the animal. Explain your reasoning

Lab total is out of 35 Points...