Sheep Eye Dissection

Question:

How do the various parts of the eye function together to make an image appear on the retina?

Materials and Equipment:

- Preserved sheep eye
- Scissors
- Dissection tray
- Tweezers
- Probe

Procedure:

1. Obtain a sheep eye; place it in your dissecting pan.
2. Rotate the eye until the large bulge (cornea) is on the top of the eye. The eye is now in the position it would be in a body as you face the body.
3. On the outside of the eye, locate the following parts:
   - **Fat**: yellow tissue that surrounds the eye and cushions it from shock
   - **Optic nerve**: a white cord on the back of the eye about 3 mm thick that carries messages between the eye and the brain
   - **Muscles**: reddish, or grey flat muscles around the eye used to raise, lower, and turn the eye
4. Examine these structures on the front surface of the eye:
   - **Eyelids**: two moveable covers that protect the eye from dust, bright light, and impact
   - **Sclera**: tough, white outer coat of the eye that extends completely around the back and sides of the eye to protect it and enclose it
   - **Cornea**: a once clear covering (preservatives make it appear cloudy) over the front of the eye that allows light to come into the eye
   - **Iris**: round black tissue through the cornea that controls the amount of light that enters the inner part of the eye (may be coloured in humans)
   - **Pupil**: the round opening in the centre of the eye that allows light to enter and whose size is controlled by the iris
5. Place the eye in the dissecting pan so it is facing you. Use your scissors to cut away the eye-lid, muscle and fatty tissue from both the front and rear surfaces of the eye if they are still intact. Be careful not to remove the optic nerve. Cut along the surface of the sclera until all the tissue is removed and your specimen looks similar to the photographs you see here. The sclera is very tough so you do not need to worry about cutting into this layer of the eye. The cloudy nature of the cornea is caused by the death of this tissue. It is transparent in the living state.

6. Place your eye specimen in the dissection pan. Turn the specimen so the cornea is on the left and the optic nerve is on your right. Using the tip of your probe, gently pierce the white part of the eye (the sclera) about 1 cm away from the edge of the cornea. Make a hole large enough for your scissor to fit through. Fluid should ooze out of the eyeball when you have cut deep enough. This fluid is known as the aqueous humour - a fluid found between the cornea and lens that nourishes the cornea and the lens and gives the front of the eye its form and shape. Take the notes you need to record what you have observed so far.
7. Insert the point of the scissors into the slit made by the probe and cut the sclera with a shallow snipping motion. Turn the eye as you continue the cutting action. Cut the sclera all the way around the ball of the eye. You will need to support the eye in the palm of your hand while you complete this step of the dissection. Do not be surprised if some fluid from the eye oozes from the slit as you make this cut.

8. Arrange the two hemispheres of the eye as you see in the left photograph. The retina lines the posterior cavity of the eye and extends forward to the ciliary body. Use your probe to lift and pull the retina back from the underlying choroid layer. See the photograph on the right side above. Notice that the retina is only firmly attached to the choroid at one place. This region is the optic disc or blind spot. Here the nerve fibres leave the retina and form the optic nerve which is directly behind the blind spot. Take the notes you need to record what you have observed so far.

- **Retina**: tissue in the back of the eye where light is focused. The surface of the retina is covered with blood vessels that bring oxygen and nutrients to the retina and remove waste.
- **Ciliary body**: black muscle fibres located on the back of the iris that change the shape of the lens
- **Blind spot**: nerve cell fibres carrying impulses from the retinal receptors leave the eye in this region and enter the optic nerve
9. Use your forceps to peel the retina away from the underlying choroid coat. The retina should remain attached at the blind spot. The choroid coat is dark and relatively thin. Use your forceps or probe to gently separate the choroid from the outer sclera. Verify that the eye has three distinct layers, the retina, choroid and sclera. See left photograph above. The choroid contains an extensive network of blood vessels that bring nourishment and oxygen to itself and the other two layers. The dark color, caused by pigments, absorbs light so that it is not reflected around inside of the eye. Take the notes you need to record what you have observed so far.

10. Now use your forceps and probe to remove the vitreous humour from the anterior hemisphere of the eye. See right photograph above. This will take some time and effort as the semi-fluid material separates easily. It helps to turn the hemisphere on edge and to use a scraping motion to remove the fluid. Try not to disturb the lens that is just below the vitreous humour.

- **Vitreous humour**: clear, jelly-like substance found behind the lens that helps to maintain the shape of the eye and supports the inner structures, such as the retina and the lens.

11. Removal of the vitreous humour reveals the lens, ciliary body and suspensory ligaments. In the normal condition the lens is transparent except, when as a condition of aging, the lens turns cloudy. The cloudy condition, called a cataract, prevents or reduces the amount of light reaching the retina. Cataracts can be treated by removing the lens and replacing it with a stiff artificial one. Take the notes you need to record what you have observed so far.
12. Remove the lens by pulling it free from its attachments. Note the shape of the lens, its stiffness and opaqueness.Suspensory ligaments may also be visible along the edge of the lens.

13. When the lens is removed, an opening allowing light to enter the eye is seen. This opening, the pupil, is located in the center of the iris. Two muscle layers of the iris regulate the size of the pupil. One layer increases the pupil size with decreasing light intensity and the other layer reduces pupil size with increasing light intensity. Note the oblong shape of the sheep pupil; in humans the pupil is circular. The back side of the iris can be seen just above the pointer in the photograph. Part of the iris is being lifted by the pointer but the iris continues all the way around the pupil opening.

A second cavity or space is present between the iris and the cornea. This space is filled with a second semi-liquid fluid, the aqueous humour. This fluid, like the vitreous humour helps to maintain the shape of the eye. Glaucoma is a condition where the fluid pressure becomes too high causing eye damage.

14. Remove the cornea from the front eye hemisphere. Use a razor blade to puncture a small slit at the boundary between the cornea and sclera. Then insert the scissors into the slip and cut all the way around the cornea to remove it. Notice the thickness of the cornea. How does it compare to the thickness of the sclera? Carefully observe the front side of the iris and pupil. Which structure of the eye would be just behind the pupil opening? Take the notes you need to record what you have observed so far.
Clean-Up and Disposal

1. Wrap the sheep eye and its parts in several layers of paper towel.
2. Properly dispose of the sheep eye in the hazardous waste container provided at the front of the classroom.
3. Thoroughly clean all dissecting tools, including the tray and gel with soap and water.
4. The gel should be in the dissection pan, cover with a clean dry paper towel.
5. Dispose of all gloves in the garbage bin.
6. Wash down all lab areas (including sinks!) with soap and water.
7. Wash your hands with soap and warm water before leaving the lab.

Analysis and Interpretation of Results

The answers to the following questions are to be typed and submitted for evaluation.

1. Sketch a labelled diagram of the eye.
2. (a) What differences did you notice between a sheep eye and a human eye?
   (b) What do the differences suggest about a sheep’s vision?
3. Explain how the flexible part of the eye works to change the ability of the eye to focus.
4. Describe how various parts of the eye function together to make an image appear on the retina.
5. What is the function of the sclera, cornea, and optic nerve? What is the function of the lens, iris, and pupil?
6. The human eye has six externally attached muscles instead of only four like the sheep’s. Predict how a human’s eye might move differently than a sheep’s eye.
7. If you enter a very bright room after being in the dark, what would happen to your pupils?
8. Why does the optic nerve cause a blind spot?
9. Why does the retina have to be smooth? Why not wrinkled? (Think about reflecting light off of a wrinkled piece of aluminum foil and a smooth piece.)
10. Think about learning the parts of the eye. We can use a diagram, a model, or a dissection to learn the parts. In your opinion, using examples from your own experience, which method (diagram, model, dissection) do you think helped you to understand the parts of the eye the most? Why?

Due Date: ____________________