Anatomy of a Cow Eye

Like Paley, we now will turn our attention to the phenomenon of adaptation. During this class period, we will examine many ways in which the eye seems to be particularly well suited for its functions begin to ask how such adaptation can be explained. While examining the cow eye, pay careful attention to how the various structures of the eye promote optimal vision for the animal.

The following excerpt from The Body Book gives an overview of how the eye works:

The apparatus of the eye resembles a camera. The camera “box” is the eyeball. The front portion of the eyeball is the transparent cornea you see through; it corresponds to a glass lens cover ... Inside the eyeball, toward the front, is a lens through which light passes before hitting the rear wall – the retina – whose pigmented light receptors act as film.

You focus a camera by moving the lens closer to or farther away from the film behind it. This is the way fish and frogs change their eye focus. Mammals change focus by changing the shape of their lens. The shape is controlled by the tension of tiny muscles attached to the lens edge. A fat lens is for close-up’s; stretching the lens thinner brings distant objects into focus.

Between the cornea and the lens is the iris, the colored circle that, like a camera’s diaphragm, adjusts the amount of light reaching the retina. Light enters the lens through the pupil, a circular opening in the middle of the iris. Muscles that circle the iris, and muscles that extend from it like spokes on a bicycle wheel, widen the pupil up to 1/3 inch to allow more light to enter, or narrow the pupil to as little as 1/16 inch to cut down on light.

Procedure:

You will dissect a cow eye, noting in particular the structures listed on page 2. Remember to pay attention to how these structures contribute to the eye’s overall function. After you have completed the dissection, answer the questions on the last page of this handout. We will start tomorrow’s discussion by going over these questions.

Dissection Guidelines:

Your goal is to identify the following structures:

- optic nerve
- lens
- extrinsic muscle attachments
- iris
- cornea
- aqueous humor
- retina
- vitreous humor
1. Begin by noting the **optic nerve** at the posterior of the eyeball and the **extrinsic muscle attachments** (those that swivel and anchor the eyeball in its socket). Also note the **cornea**, which may be clouded if the eyeball has been preserved.

2. Carefully remove the fat and muscle tissue, leaving the optic nerve intact. With the cornea facing downward, make an incision about 1/4 inch above the cornea. Continue the incision around the entire eyeball, moving parallel to the corneal edge.

3. Lift the posterior part of the eyeball (which should contain the vitreous humor) away from the lens.

4. In the anterior portion of the eye, you should be able to examine the following structures:

   - **lens**: this is a biconvex (curved outwardly on both sides) structure that may appear opaque. The shape of lens is controlled by ciliary muscles (small muscles attached to the lens). The flexibility of the lens is what enables it to focus images onto the retina.

   - **ciliary body**: this is a black pigmented body that appears to surround the lens

5. Still working with the anterior portion of the eye, carefully remove the lens and note the following structures:

   - **aqueous humor**: this is a clear watery fluid contained in a chamber anterior to the lens. It provides nutrients for the lens and cornea and maintains intraocular (within the eye) pressure. Maintenance of correct intraocular pressure is important for the health of the eye: for example, the disease glaucoma is caused by an increase in intraocular pressure.
iris: the pigmented iris is composed of muscle fibers and acts as a diaphragm, regulating the amount of light entering the eye. It controls the aperture of the pupil.

cornea: this is a tough transparent membrane that both protects the eye and allows light to enter it.

6. Examine the posterior portion of the eyeball. Note the following structures:

vitreous humor: this is a gel-like substance that maintains the pressure of the eye.

retina: a delicate white membrane at the posterior of the eyeball. The retina contains the specialized cells, rods and cones, that transmit light energy into nerve impulses. These nerve impulses are then transmitted to the optic cortex of the brain (via the optic nerve).

References:


for additional information, see the following WEB sites:

http://netra.exploratorium.edu/learning_studio/cow_eye/

http://www.exploratorium.edu/xref/exhibits/eyeball_machine.html
Discussion Questions:

1. Describe one of the parts of the eye you examined today in class and discuss how the structure of that part fits its function.

2. How could your answer to question 1 above be used by Paley in his argument for a “designer”? 