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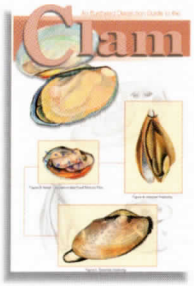

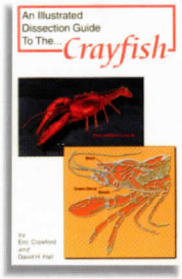

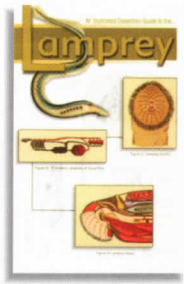

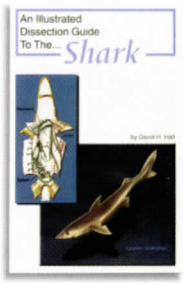

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An Illustrated Dissection Guide to the...

Mammalian Eye

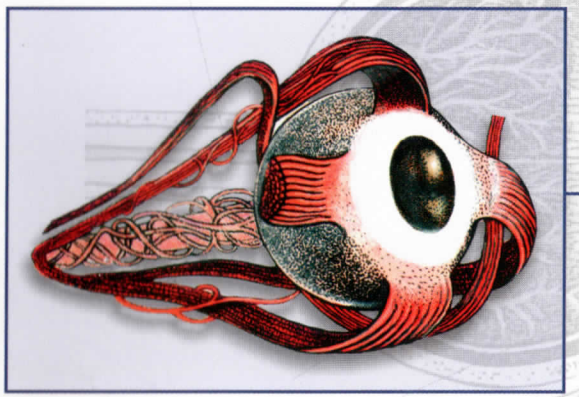

Figure 1: External features.

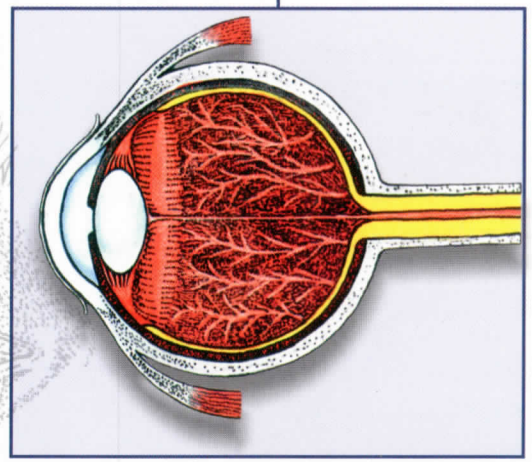

Figure 2: Transverse section of the eye.

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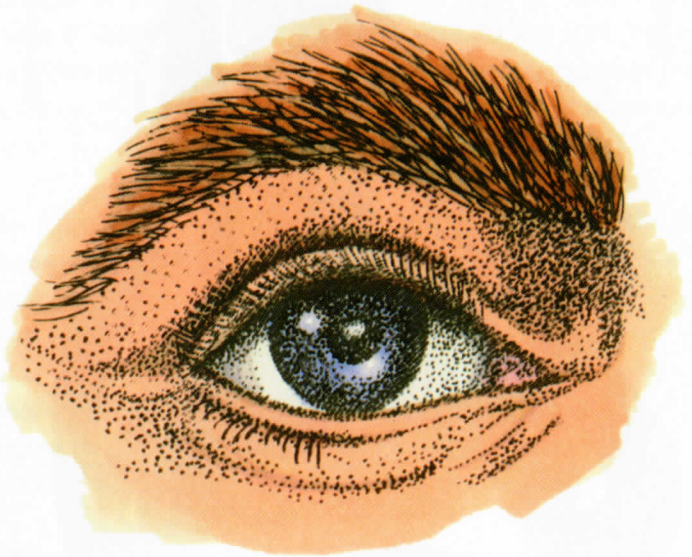


Before beginning the dissection of your mammalian eye familiarize yourself with its external anatomy. Preserved eye specimens usually have excess connecting and fatty tissue. Carefully trim these tissues away. Do not remove any brown muscle tissue or the nerve cord that exits out of the back of the eye. With a tweezer and scissors, carefully cut excess tissue away. This can be a time consuming task but is well worth the effort.

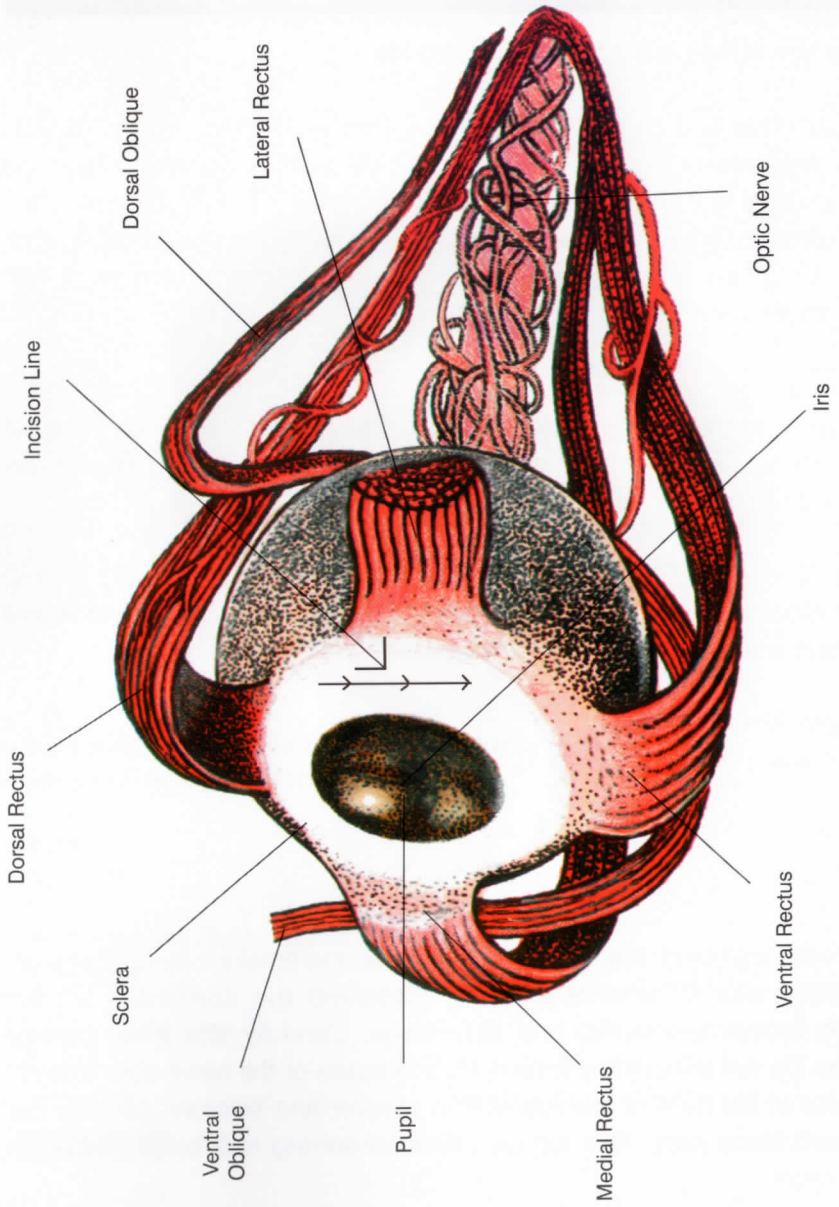


Figure 1: External Features.

Identify the following external features pointed out in **Figure 1** with your specimen:

Pupil: This is the opening that allows light into the interior of the eye. The size of the pupil is regulated by the iris.

Iris: This is a circular, pigmented, adjustable diaphragm that controls the diameter of the pupil. The size of the pupil is determined by how much light is available for the eye to receive. In low light, the iris opens to allow more light to enter the eye through a larger pupil. In bright light, the iris closes creating a smaller pupil that restricts the amount of light entering the eye.

Sclera: The tough outer membrane of the eye. The sclera is opaque except where it covers the iris and pupil. In these areas the sclera is transparent and is called the **cornea** (see Figure 2). The sclera provides support and protection.

Six External Ocular Muscles: These muscles rotate and aim the eye for directed vision. They are grouped into three pairs: Dorsal and ventral rectus, medial and lateral rectus, and dorsal and ventral oblique.

Optic Nerve: This large nerve cord collects and conducts impulses from the retina of the eye to the brain.

Interior Anatomy Of The Eye

With a scalpel make an incision on the sclera just beside the cornea as shown in Figure 1. Using fine tipped scissors continue this cut around the eye until you meet the opposite end of the original incision. Free the two uneven halves to reveal the interior of the eye.

Identify all of the features listed in **Figure 2**:

Anterior (Outer) Chamber: The space is between the cornea and the iris and contains a clear, watery fluid called **aqueous humor**. The small space between the lens and the iris is known as the posterior chamber.

Inner Chamber: The space between the lens and the retina. This chamber is filled with viscous vitreous humor.

Lens: This transparent, elastic, oval structure acts exactly like the lens of a telescope: bending rays of light to focus them on a specific spot within the retina. The difference between the inorganic telescope lens and the organic lens of the mammalian eye is that the telescope lens needs to travel back and forth in a tube to change focus when looking at different distances. The organic lens is elastic and changes its with the aid of ciliary muscles to focus light rays on the retina.

Ciliary Muscle: These are the muscles that control and alter the shape of the lens. They are connected to the lens by suspensory ligaments. The ciliary muscle also secretes the aqueous humor which inflates the anterior and posterior chambers of the eye.

Vitreous Humor: This is a colorless, transparent, jelly-like material that is under pressure to maintain the shape of the eye's interior.

Choroid Layer: This middle membrane is rich in blood vessels. These vessels supply the retinal cells with blood for nourishment. The choroid layer is also darkly pigmented to block light from reflecting back into the retina.

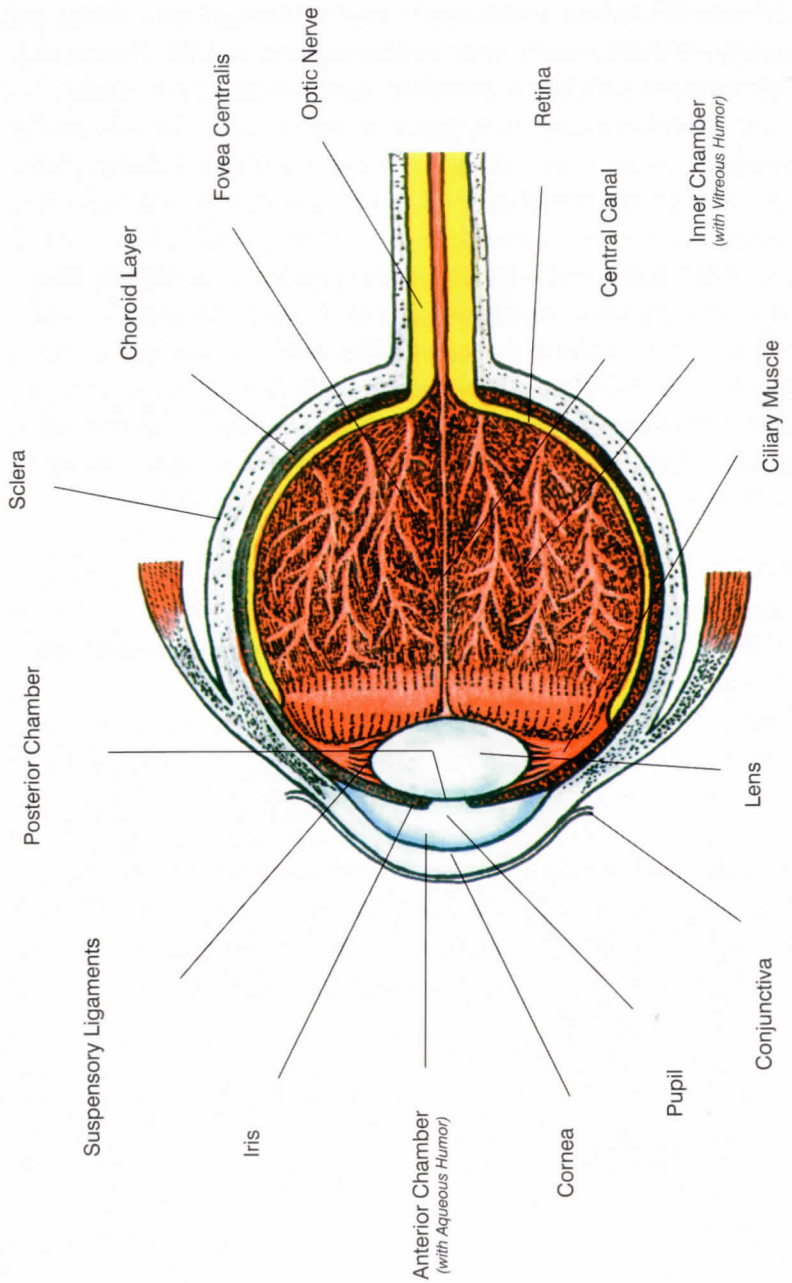


Figure 2: Transverse section of the eye.

Retina: The inner layer of the eye that is composed of photoreceptors, the light sensitive cells. Light sensitive cells are divided into two types: **rods** and **cones**, named because of their cellular shape. There are approximately 125 million rods and 1 million cones in each human eye. Rods are concerned with black and white vision or grey scale. Cones are responsible for color vision. Both types of retinal cells contain special light-sensitive pigments. Rods contain light-sensitive pigment rhodopsin. The composition of cone pigments are not well characterized yet but are believed to be similar to rhodopsin. When light strikes the pigments, this triggers a series of molecular shape changes and enzymatic reactions. These in turn, generate a nerve impulse that is transmitted to the brain. The pigments are rapidly rebuilt ready to receive more light by the action of special enzymes and the vision important vitamin A. Cones need about 50 times more light to be stimulated than rods. That is why night vision is almost totally rod vision. Some nocturnal (night) animals (like bats and owls) have only rods in their retinas.

Fovea Centralis: This is the region of sharpest vision, is located in the center of the eye in direct line with the lens and contains only cones.

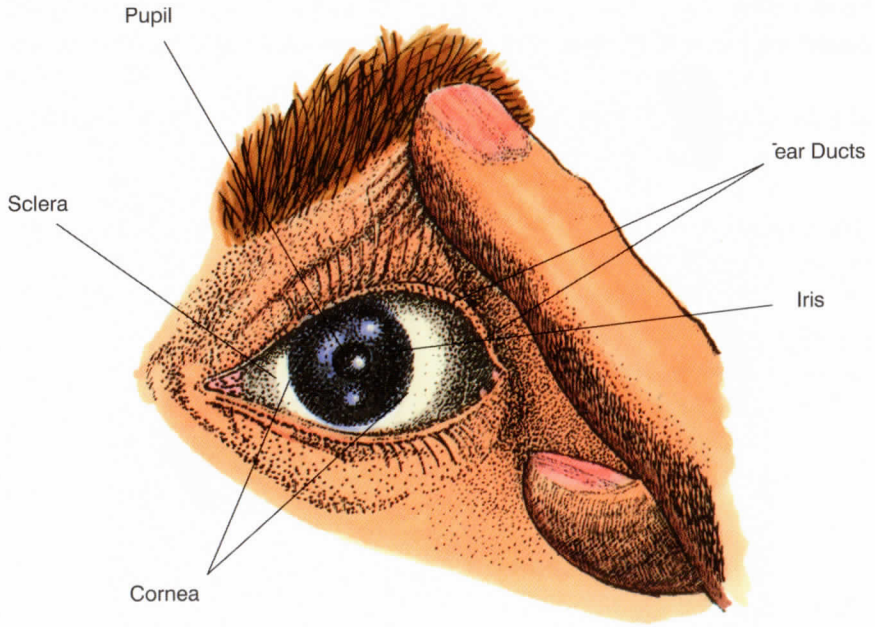
Conjunctiva: The thin mucus membrane that lines the exposed surface of the eyeball and the inner surface of the eyelid.

Blind Spot: A small region of the retina that lacks rod or cone cells and is where nerve fibers exit the eyeball.

Central Canal: This small channel is all that remains of an artery present during fetal development and is difficult to locate.

Vertebrate Eyes

Vertebrate eyes need to keep a sharp image of moving objects on their retinas in order to keep the objects in focus. Different vertebrates accomplish this in different ways. To focus, a lens can either: **1)** change position by moving or **2)** change shape. In lampreys and bony fish, the normal state of the eye is that it is focused for near vision. For fish to focus on distant objects, the lens is moved backwards. Shark, amphibian and snake eyes are focused on distant objects in their normal states but are moved forward to focus on near objects. Mammals, birds and other reptiles focus on distant objects but adjust the curvature of the lens by allowing it to form into a rounder shape, rather than by moving the lens. The lens is elastic and muscles relax, loosening tension from ligaments that suspend the lens and the lens becomes thicker and rounder. This change is called accommodation.



Look into a mirror and identify the external features of your own eye.