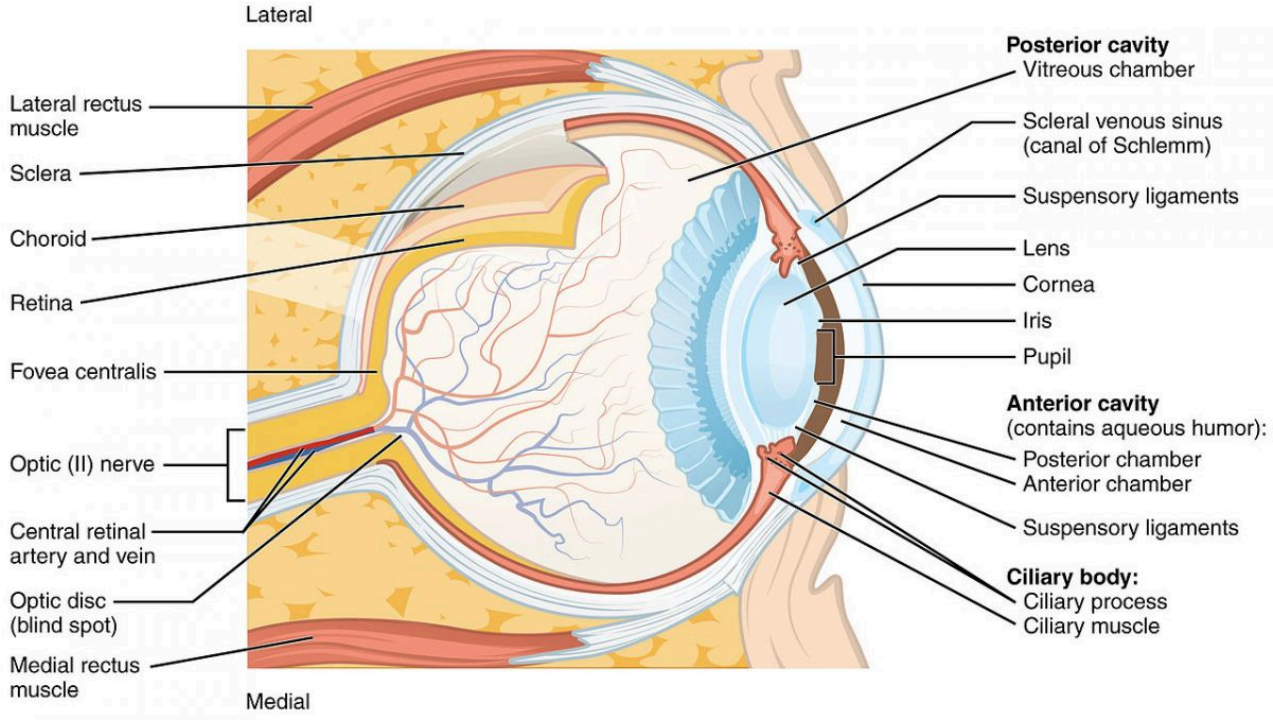
2.7.1

Structure of the Eye

The eye is a hollow, fluid filled organ that is surrounded by three layers of tissue (see image below). The outermost layer is composed of connective tissue and there are no blood vessels penetrating this layer. It can be divided into two parts, the **sclera**, the white part of the eye comprising the posterior 5/6 of the eyeball, and the **cornea**, the clear window on the anterior surface of the eye. The sclera helps protect the eye and also provides a site of attachment for the six muscles responsible for the movement of the eye. The cornea is transparent and functions as the major refractor of the light as it enters the eye. Its transparency is due to the nature of the collagen and proteoglycan fibers that form it. Following are a couple of pictures that help orient us to the anatomy of the eye.



Anatomy of the eye

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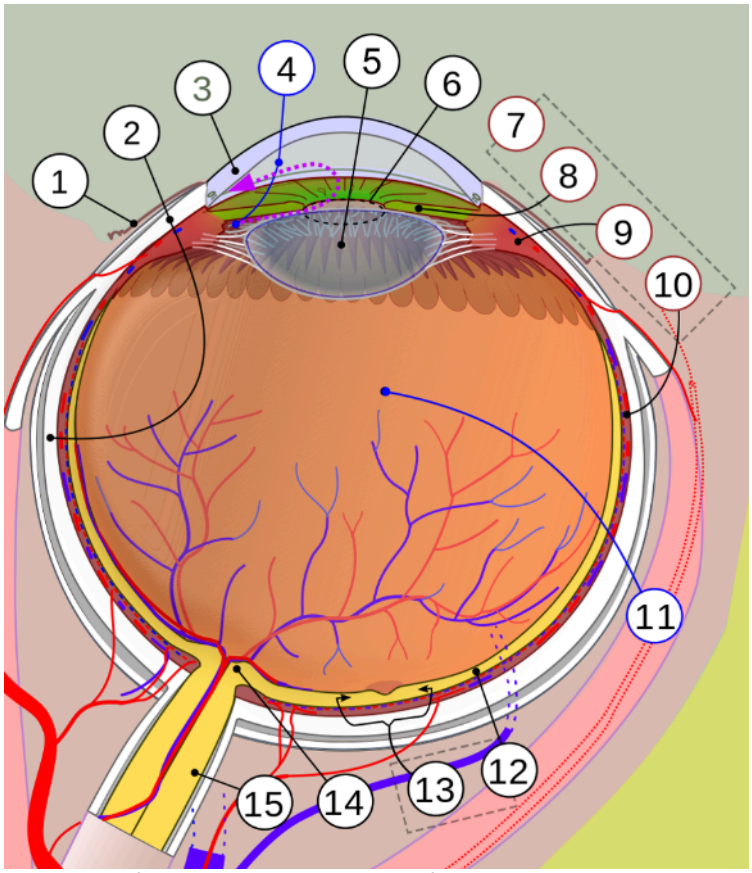
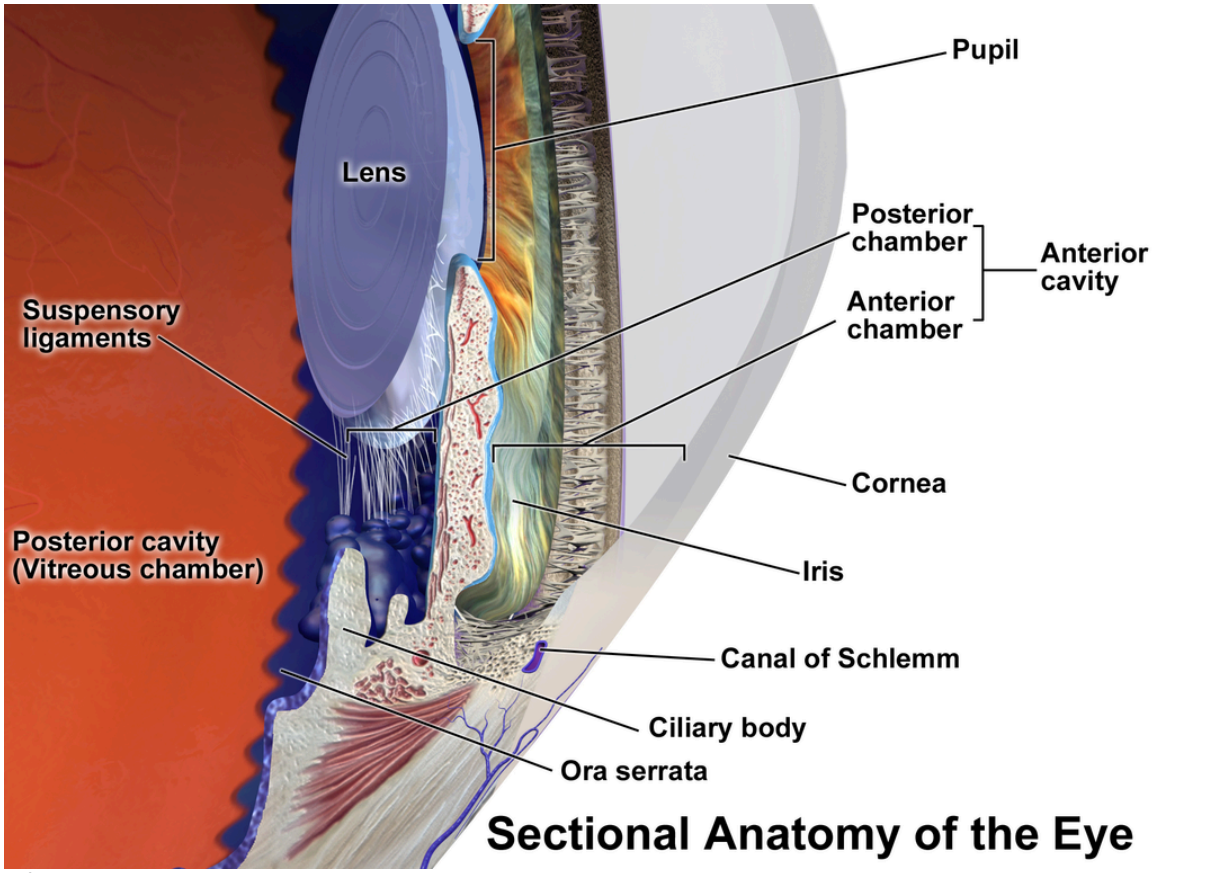


Diagram of Human Eye. Title: File: Simple diagram of human eye multilingual.svg; Author: Jmarchn; Site: https://commons.wikimedia.org/wiki/File:Simple_diagram_of_human_eye_multilingual.svg; License: This file is licensed under the Creative Commons Attribution-Share Alike 3.0 Unported license

1. Conjunctiva
2. Sclera
3. Cornea
4. Aqueous humour (in anterior and posterior chambers. See purple dotted line)
5. Lens
6. Pupil
7. Uvea with
8. Iris
9. Ciliary body and
10. Choroid
11. Vitreous humor
12. Retina with
13. Macula or macula lutea
14. Optic disc → blind spot
15. Optic nerve

The middle layer of the eye is the **vascular tunic**. Most of the blood vessels of the eye can be found in this layer. The picture above shows blood vessels of the retina. The blood vessels of the vascular tunic are not shown. If they were shown, you would see them associated with the choroid in the image. The posterior portion of this layer is the choroid. Anteriorly the choroid is continuous with the **ciliary body**. The ciliary body is composed of a ring of smooth muscle, the **ciliary muscle**, and the **ciliary processes**. The ciliary muscle is a sphincter-like muscle that is attached to the lens capsule via the suspensory ligaments. It is responsible for adjusting the thickness of the lens. The ciliary processes are secretory structures that produce the **aqueous humor** that fills the compartment in front of the lens.



Anatomy of the Eye. Title: Blausen 0390 EyeAnatomy Sectional.png; Author: BruceBlaus; Site: https://commons.wikimedia.org/wiki/File:Blausen_0390_EyeAnatomy_Sectional.png; License: This file is licensed under the Creative Commons Attribution 3.0 Unported license

The most anterior part of the vascular tunic is the iris. The iris is composed primarily of smooth muscle containing varying amounts of the pigment melanin. The amount of melanin determines eye color, large amounts produce brown eyes, while smaller amounts result in blue or green eyes. The iris is actually two layers of muscle with a circular hole in the center, the **pupil**. The **sphincter pupillae** is a circular layer that causes the pupil to constrict (**miosis**) when it contracts and the **dilator pupillae** is a radial layer that causes the pupil to dilate (**mydriasis**) when it contracts. These layers are innervated by the autonomic nervous system, the dilator is under sympathetic control and the sphincter is under parasympathetic control.

The innermost layer is the **neural tunic** or **retina**. There are actually two distinct layers of the retina. The **pigment epithelium** is a layer of simple cuboidal epithelium that sits on the choroid. This layer has large amounts of melanin giving it a dark black color. One important function of the pigmented retinal is to absorb light that doesn't strike the photoreceptors and prevent it from being reflected inside the eye. The **neural layer** is the innermost layer of the wall of the eye and contains the photoreceptors that are stimulated by the entering light. Two distinct anatomical structures on the retina are the **optic disk** and the **fovea centralis**. The optic disk, also called the blind spot, is the point where the optic nerve and blood vessels enter the eye. There are no photoreceptors in this area and hence light striking the optic disk cannot be detected. The fovea centralis (fovea = pit) is a small indention located in the center of a special area of the retina called the **macula lutea** (macula = body, lutea = yellow). The macula is roughly 5 mm in diameter, about the diameter of a pencil eraser, and the fovea is about the size of the head of a pin. When you look at an object the light coming directly from that object focuses on the fovea, it is the portion of the retina with the greatest visual acuity (clarity).

The **lens** is not technically part of any of these three layers but it is obviously extremely important in focusing light. It is a biconvex structure composed of transparent cells (epithelial cells). These cells have lost their nuclei and other organelles and are filled with transparent proteins called **crystallines**. It is surrounded by the very elastic lens capsule which, in turn, is attached to the ciliary muscles by the suspensory ligaments. When there is no tension on the

suspensory ligaments (ciliary muscles are contracted) the lens assumes its natural shape, this is when it is at its thickest. When the ciliary muscles relax the tension on the suspensory ligaments increases and the lens flattens. Remember the ciliary muscle is a sphincter muscle so when it contracts its diameter decreases, reducing tension on the ligaments attached to the lens capsule.

The lens divides the eye into two fluid filled compartments. The **anterior cavity** is the space between the lens and the cornea. As was mentioned above, this cavity is filled with the **aqueous humor** produced by the ciliary processes. Aqueous humor is a watery fluid produced continually and circulates through the cavity before being reabsorbed into the blood. It is important in maintaining proper intraocular pressure as well as circulating nutrients and removing wastes to the cells of the lens and cornea. If the normal circulation is blocked it can result in an inappropriate increase in pressure, a condition known as **glaucoma**. If not treated, glaucoma can result in vision loss and blindness. You may see some anatomy texts divide the anterior cavity into two "chambers." The anterior chamber of the anterior cavity would be between the cornea and the iris. The posterior chamber of the anterior cavity would be a very small space between the iris and the lens. The **posterior cavity** is the space behind the lens. This compartment is filled with **vitreous humor**. Vitreous humor is more of a gel, similar to egg white. It also is important in maintaining intraocular pressure, but unlike aqueous humor, turns over very slowly.