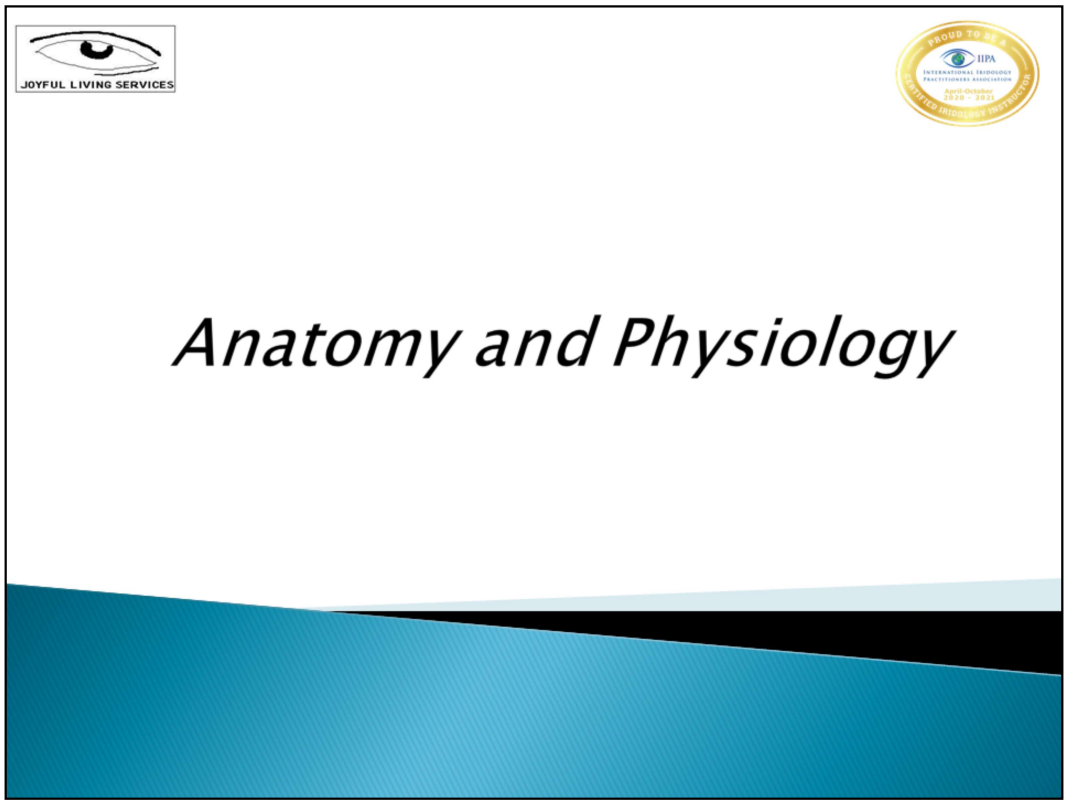
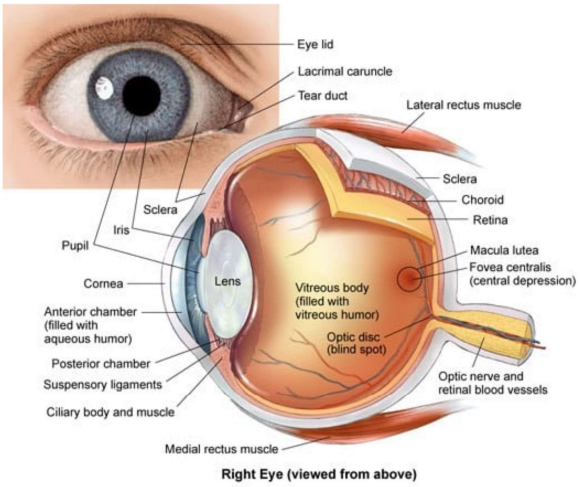


Welcome everyone!

JOYFUL LIVING SERVICES

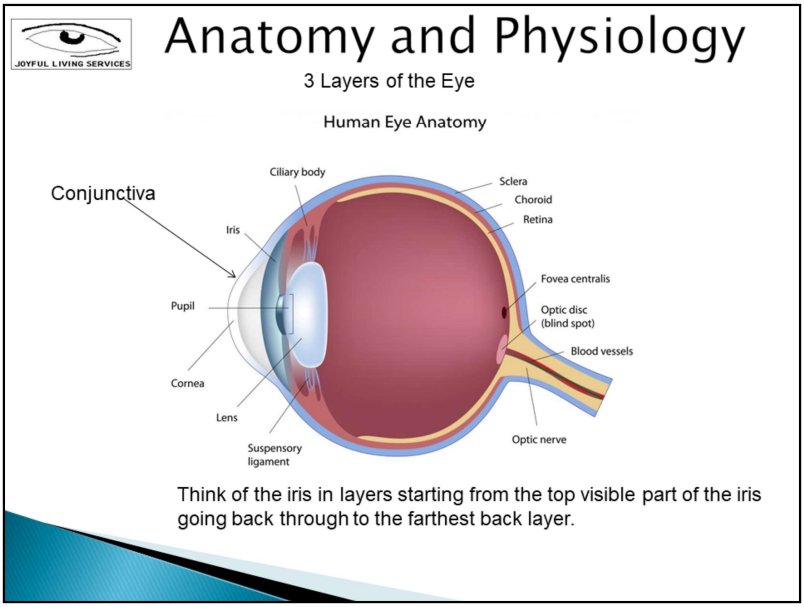
Anatomy and Physiology



Right Eye (viewed from above)

Think of the iris in layers starting from the top visible part of the iris going back through to the farthest back layer.

- The eye is our organ of sight. The eye has a number of components which include but are not limited to the cornea, iris, pupil, lens, retina, macula, optic nerve, choroid and vitreous.
- **Cornea**: clear front window of the eye that transmits and focuses light into the eye.
- **Iris**: colored part of the eye that helps regulate the amount of light that enters. **The iris is estimated to contain more than 28,000 nerve endings and is approximately the size of a dime or 12mm**. This is the thickest part of the collarette.
- **Pupil**: dark aperture in the iris that determines how much light is let into the eye
- **Lens**: transparent structure inside the eye that focuses light rays onto the retina
- **Retina**: nerve layer that lines the back of the eye, senses light, and creates electrical impulses that travel through the optic nerve to the brain
- **Macula**: small central area in the retina that contains special light-sensitive cells and allows us to see fine details clearly
- **Optic Nerve**: connects the eye to the brain and carries the electrical impulses formed by the retina to the visual cortex of the brain
- **Vitreous**: clear, jelly-like substance that fills the middle of the eye



The eye can be divided into 3 layers:

Outermost or Fibrous Layer:

Conjunctiva – A mucous membrane lining covering the sclera and inside of the eyelids.

Cornea – A transparent covering centrally located at the front of the eye. Light entering the eye is refracted by the cornea.

Sclera – The white part of the eye providing attachment to the extraocular muscles responsible for the movement of the eye.

Middle or Vascular Layer:

Choroid – A layer of connective tissue and blood vessels. It provides nourishment to the outer layers of the retina. The choroid, the iris, and the ciliary body form the uveal tract.

Ciliary Body – Comprised of two parts: the ciliary muscle and ciliary processes. The ciliary muscle consist of a collection of smooth muscle fibers. These are attached to the lens of the eye by the ciliary processes. The ciliary body controls the shape of the lens and also contributes to the formation of aqueous humor.

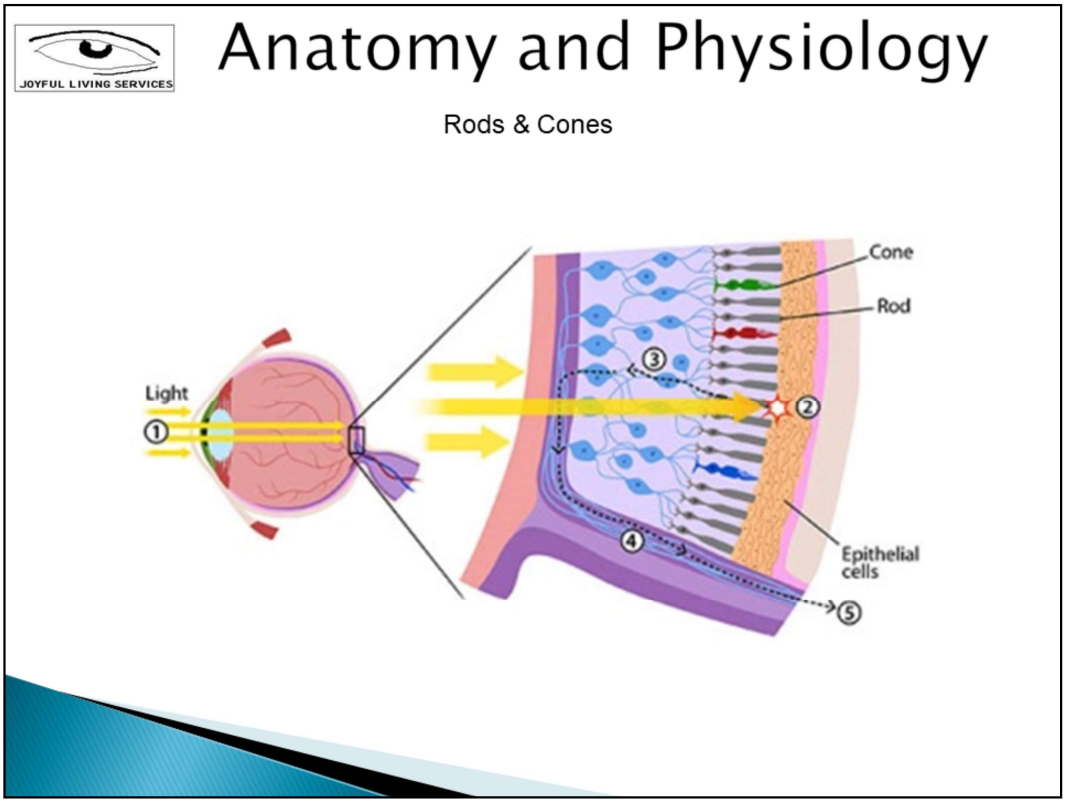
Iris – The colored circular structure with an aperture in the center (called the pupil). The diameter of the pupil is altered by smooth muscle fibers within the iris which are innervated by the autonomic nervous system. It is situated between the lens and the cornea.

Inner Layer:

Retina – The light detecting part of the eye. Located inside the retina are two cellular layers known as the rods and cones.

Rods – Enable us to see in poor lighting or the dark while the cones help us see fine detail and color. When light is refracted to the rods or cones it is changed into an electrical impulse via the optic nerve and relayed to the brain.

Canthus – Located at the corner of the eye (nasal/medial).

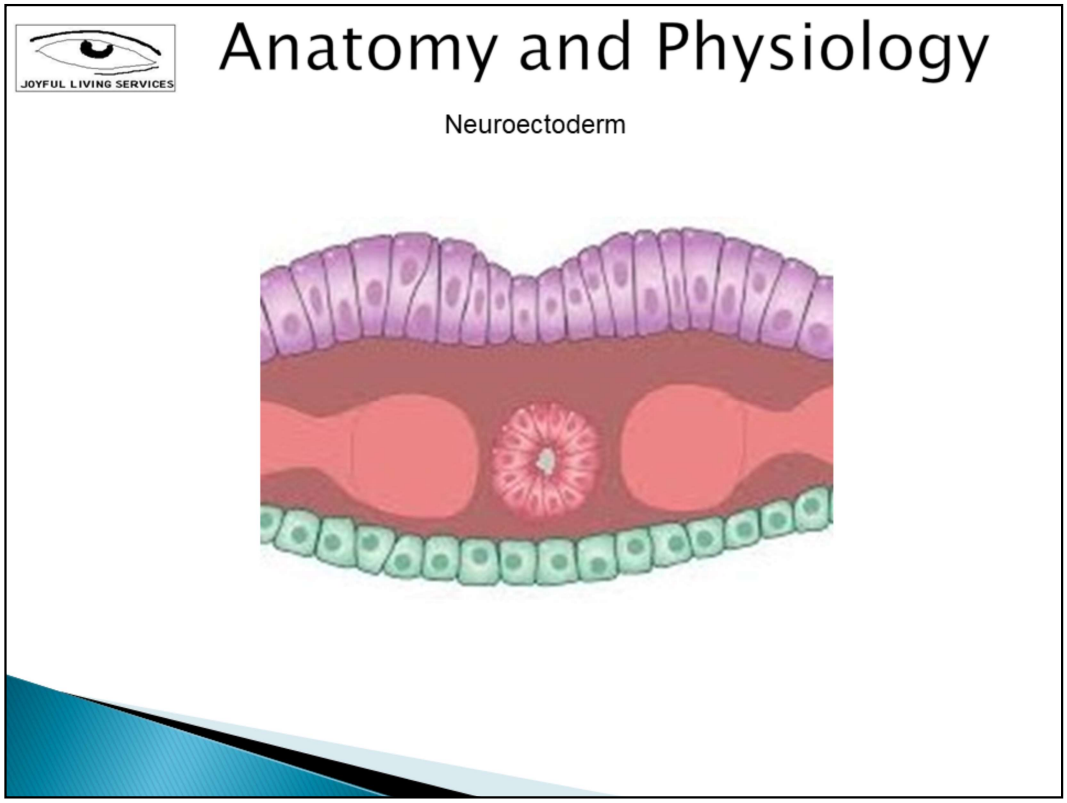


The back of the eye is lined with a thin layer called the retina. This is where the photoreceptors are located. If you think of the eye as a camera, the retina would be the film. The retina also contains the nerves that tell the brain what the photoreceptors are "seeing.“

There are two types of photoreceptors involved in sight: **rods and cones**.

Rods work at very low levels of light. We use these for night vision because only a few bits of light (photons) can activate a rod. At night we see everything in a gray scale. The human eye has over 100 million rod cells.

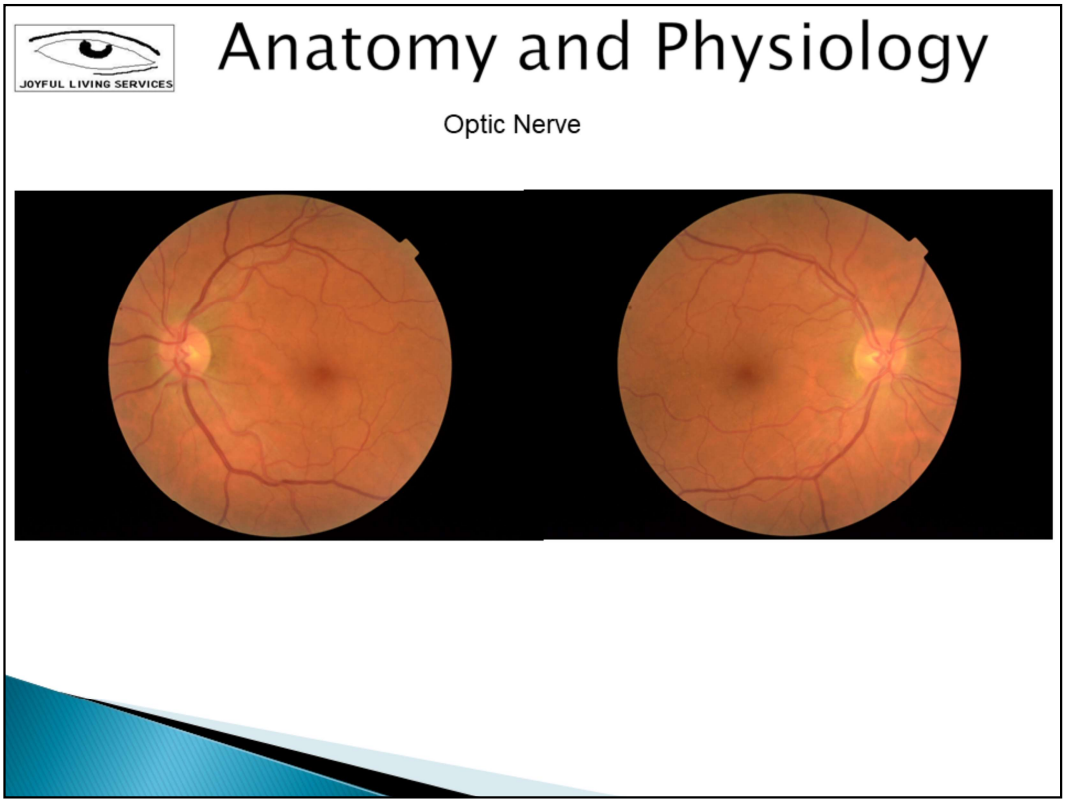
Cones require a lot more light and they are used to see color. We have three types of cones: blue, green, and red. The human eye only has about 6 million cones. Many of these are packed into the fovea, a small pit in the back of the eye that helps with the sharpness or detail of images.



The pigment epithelium and muscles are formed from **neuroectoderm**. This is the same tissue that makes up the brain and spinal cord as well as into the nervous tissue of the peripheral nervous system.

Muscles made from neuroectoderm are found only in the iris.

Formation of the **neuroectoderm** is the first step in the development of the nervous system.



This picture shows a fundus showing the back of the retina. The white circle is the beginning of the optic nerve.

The **optic nerve** is a bundle of about one million nerve fibers that transmit nerve impulses from the retina to the brain.

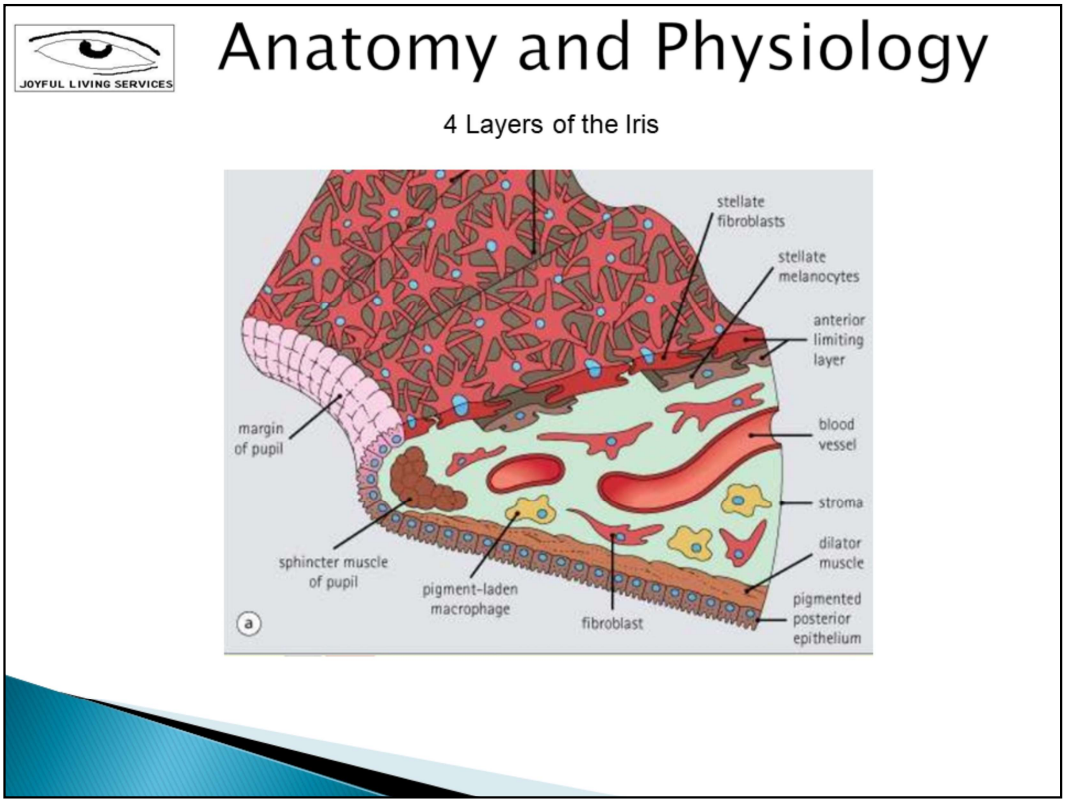
The optic nerve may be divided in the four parts as indicated in the image at the top of this section (this view is from above as if you were looking into the orbit after the top of the skull had been removed):

1. the optic head (which is where it begins in the eyeball (globe) with fibers from the retina;

2. orbital part (which is the part within the orbit).

3. intracanicular part (which is the part within a bony canal known as the optic canal); and,

4. cranial part (the part within the cranial cavity, which ends at the optic chiasm).



There are 4 layers of the iris:

Anterior border layer – Connective tissue (collagen fiber) and pigment relating to the iris color.

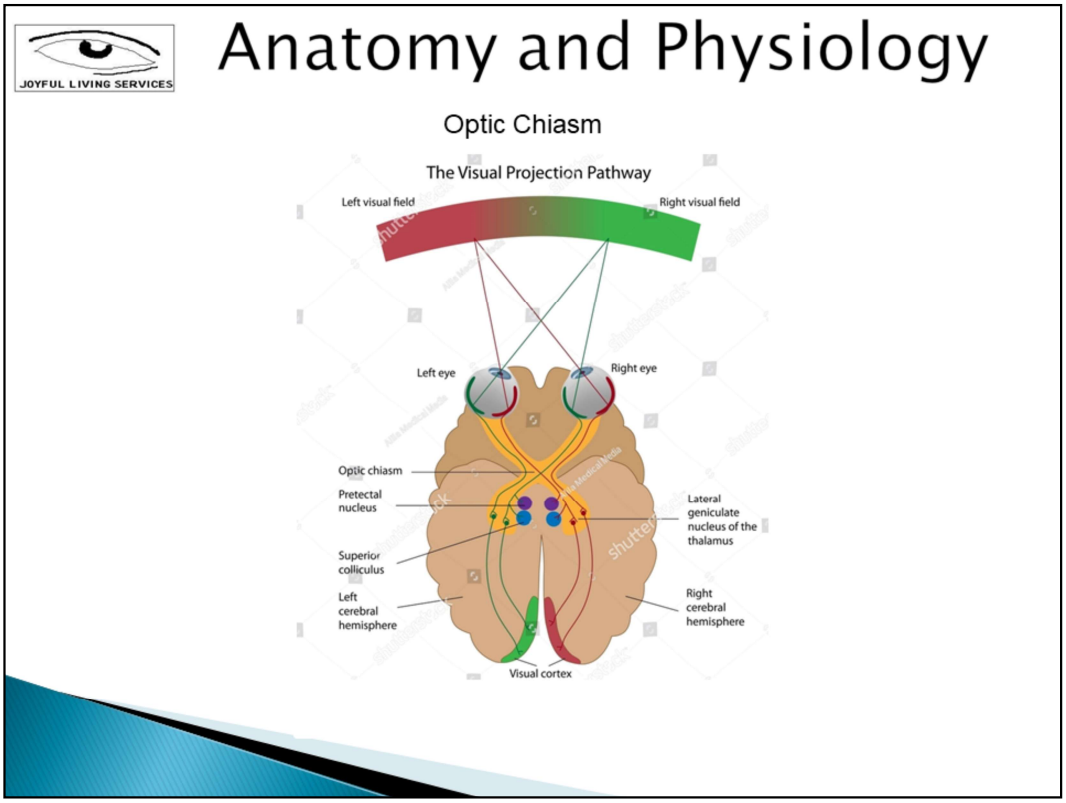
Stroma – Highly vascularized blood vessels that appear as fibers seen on the anterior surface.

Muscle layer – Controls the constriction and dilation of the pupil, posterior membrane. Two types of iris muscle, the sphincter and dilator muscle.

Posterior epithelium – Is also known as the dilator layer and is made of two layers of heavily pigmented cells that line the back of the iris. They will curl around the pupillary border creating a pigmented ruff that can be seen without magnification. The posterior epithelium also prevents light from penetrating light into the back of the eyeball.

At the optic chiasm, the nerve fibers from half of each retina cross over to the opposite side of the brain. Because of this action, each half of the brain receives visual signals from the visual field of both eyes.

Damage to the back of the head can cause vision to be distorted or damaged. Diseases that can affect the optic chiasm are multiple sclerosis, tuberculosis, non-cancerous tumors or cysts, vascular disorders, and cancerous tumors.

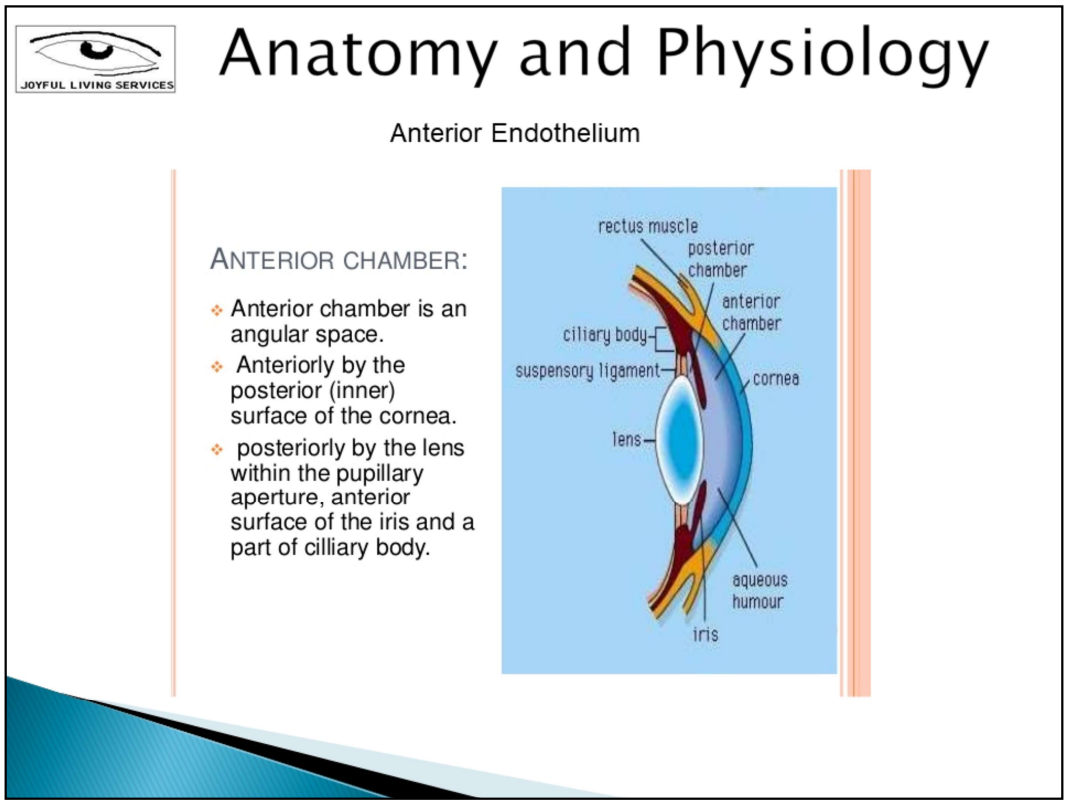


The **optic chiasm** or **optic** chiasma **is** an X-**shaped** space, located in the forebrain, directly in front of the hypothalamus. Crucial to vision, the left and right **optic** nerves intersect at the **chiasm**, thus creating the hallmark X-shape.

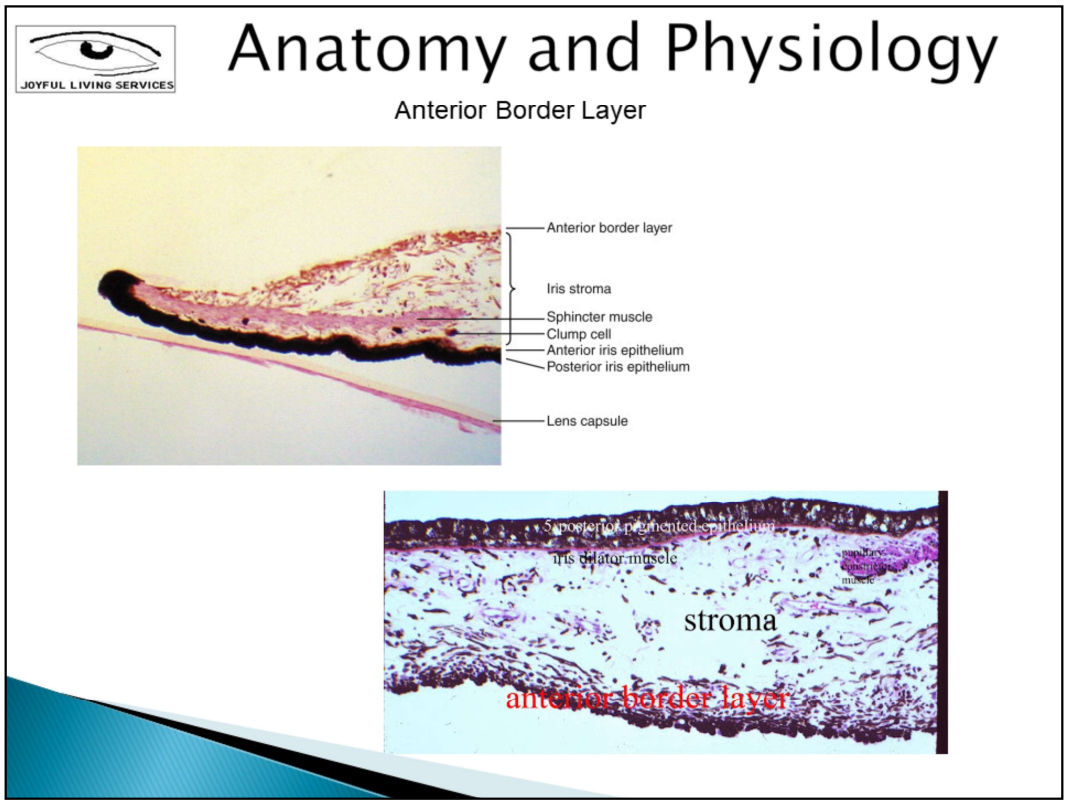
The **optic** nerve connects the brain to the eye.

Damage to the retina or one of the **optic** nerves before it reaches the **chiasm** results in a loss of vision that is limited to the eye of origin. ... In contrast, **damage** to the **optic chiasm** results in visual field deficits that involve noncorresponding parts of the visual field of each eye.

The right hemisphere for the most part controls the left side of the body while the left hemisphere controls the right side. In iridology we notice the left eye reflects the left side of the body while the right eye reflects the right side of the body. Some organs that lie within the center meridian of the body tend to show in both eyes such as the heart, liver, and pancreas.

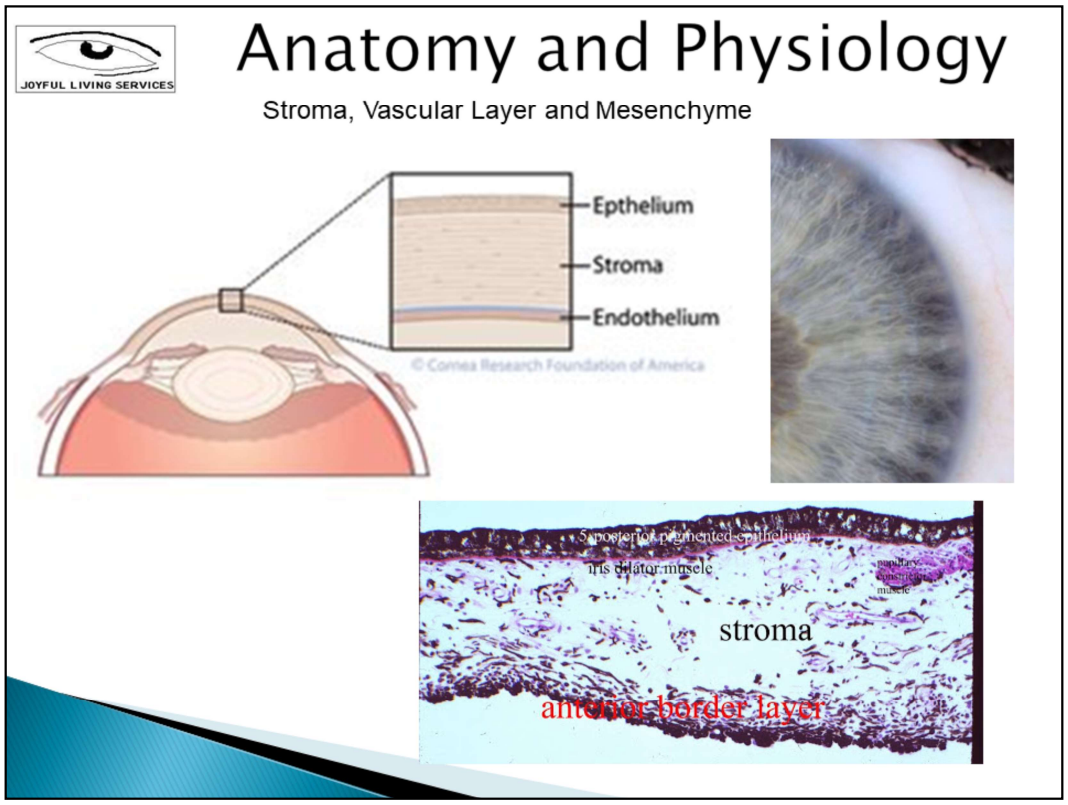


The **anterior endothelium** is invisible to the naked eye. It is located at the very top outermost part of the iris and consists of a single layer of flattened cells. The anterior endothelium is a continuation of the posterior surface of the corner. Because this layer can only be seen under very high powered magnification, it has little significance in our study of the iris or the field of iridology.



Just behind the flattened invisible anterior endothelium is the **anterior border layer**. This is the layer where the pigment is located and that provides the color of the iris. Depending on the density of this layer and the amount of pigmentation, the anterior border layer helps determine the color of the iris. In the blue iris, this layer is thin and has only a few pigment cells; in the brown iris, it is thick and densely pigmented.

Within the anterior border layer are intertwining processes of connective tissue and pigment cells.

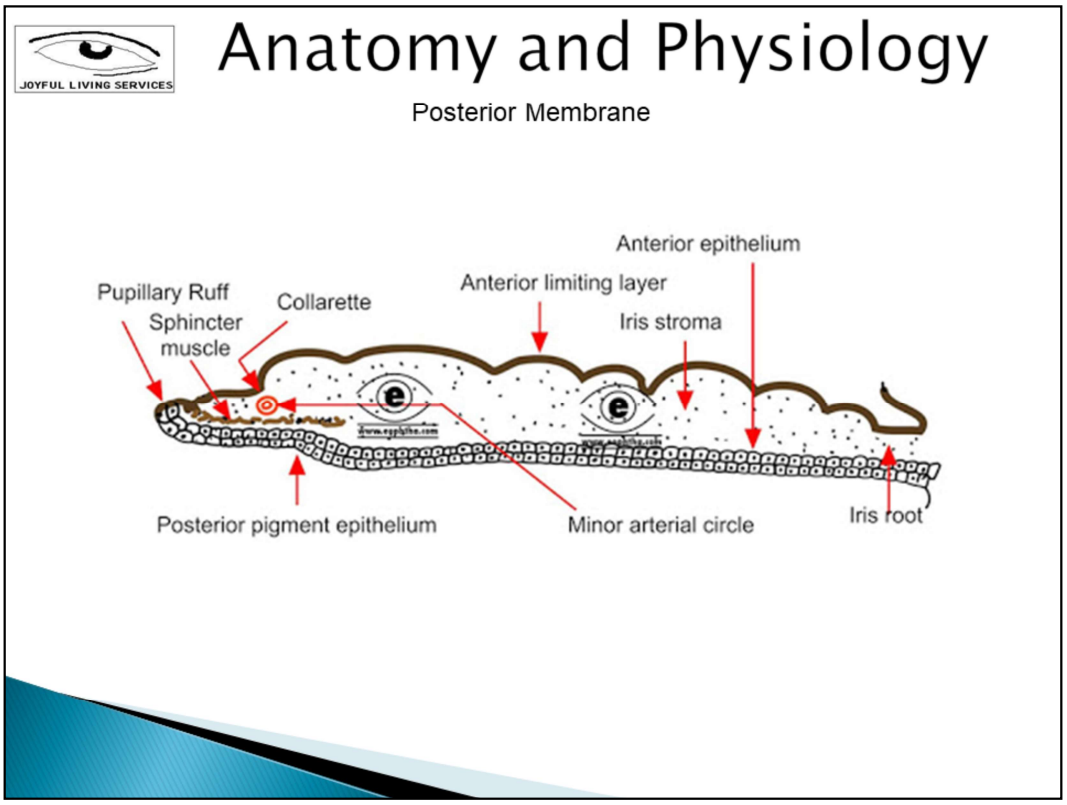


In back of the anterior border layer lies the **stroma**. The stroma is made up of blood vessels enmeshed with connective tissue and constitutes the bulk of the iris. The blood vessels within the stroma run radially, giving rise to the streaks that can be seen on the anterior surface. It is important to remember that the stroma is vascular and not muscular. Each blood vessel of the stroma is wrapped in a collagen sheath similar to the way nerves are covered by the protective Schwann sheath or myelin sheath. These vessels are called iris fibers or trabeculae.

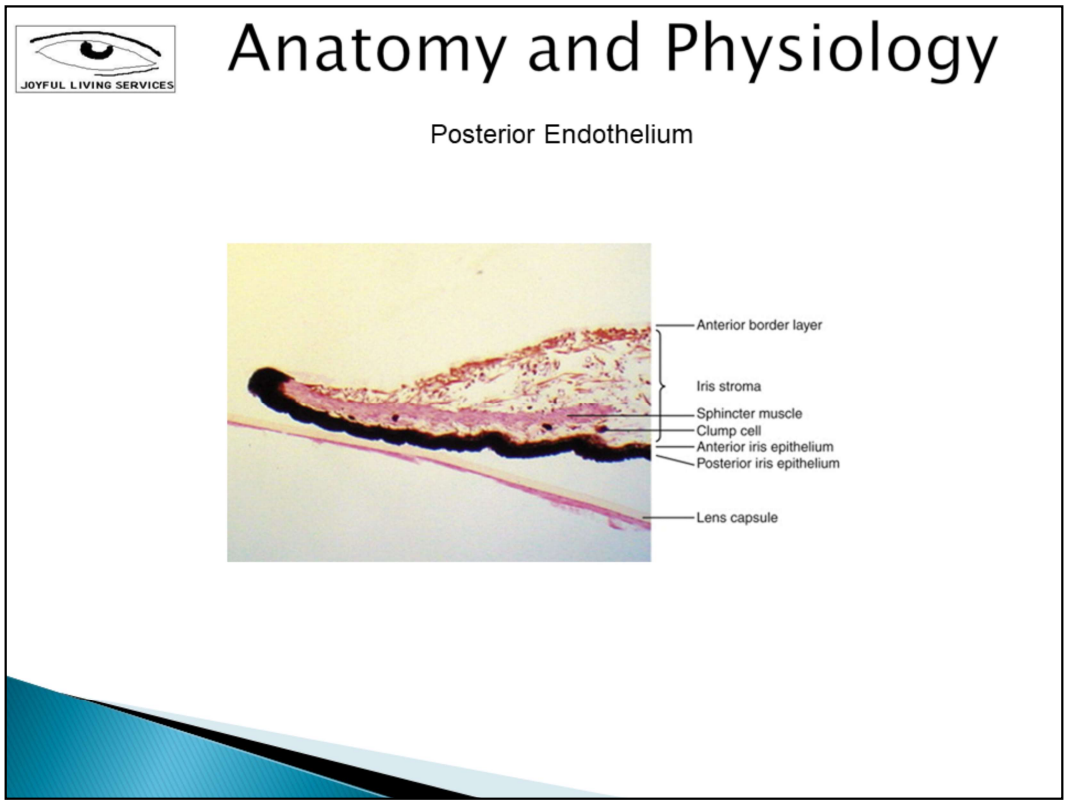
Mesenchyme is a type of tissue comprised of loose cells embedded in the mesh of proteins and fluid called the extracellular matrix.

The loose fluid of mesenchyme allows its cells to migrate easily and play a crucial role in the origin and development or morphological structures during the embryonic and fetal stages of life.

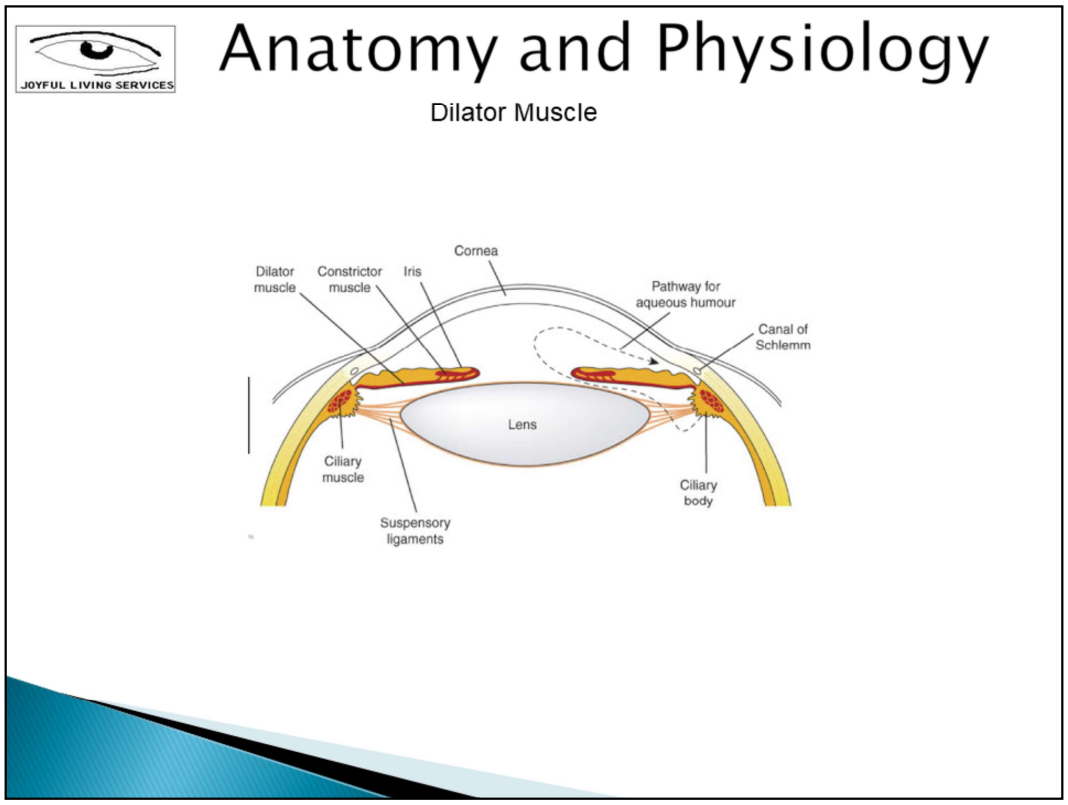
Mesenchyme gives rise to most of the body's connective tissues, from bones to cartilage to the lymph and circulatory systems.



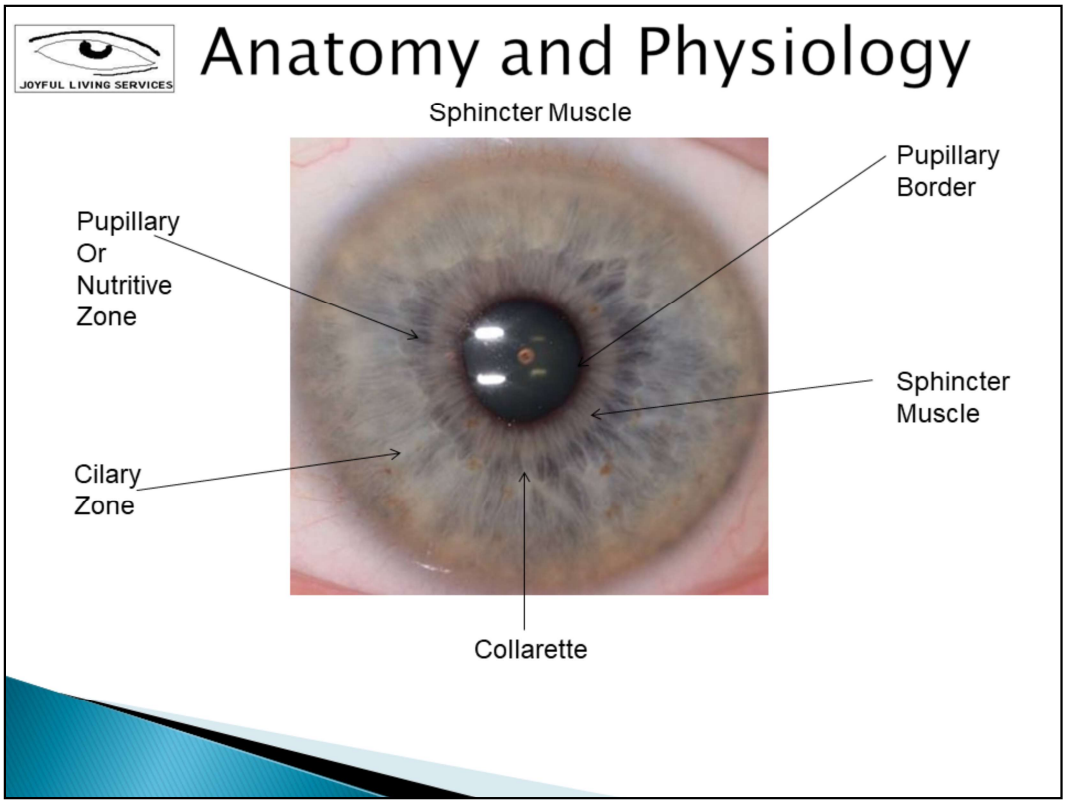
Behind the stroma or bulk of the iris is a layer of muscle called the **posterior membrane**. This membrane is also called the dilator layer because it is responsible for the dilation of the pupil when it is exposed to darkness and thus allows the person to see better in the dark. The posterior membrane consists of a thin layer of plain muscle fiber. When it contracts, it draws the pupillary margin inward, causing the pupil to dilate.



The very back layer of the iris, which lies behind the posterior membrane is the **posterior endothelium**. This consists of two layers of highly pigmented cells. These line the back of the iris and curl around the pupillary margin, creating the black fringe that provides a border to the pupil and can be seen with the naked eye. This black fringe is also called the pupillary border or pupillary ruff and encircles the pupil. This darkly-pigmented posterior endothelium layer serves to prevent the penetration of light through the iris into the posterior chamber of the eyeball. When pigments start to form in the cells of the anterior border layer of the iris, they diffuse from the posterior endothelium.



The **Dilator Muscle** is composed of cells characteristic of both posterior pigment epithelium and muscle. The dilator muscle is innervated mostly by the sympathetic aspect of the autonomic nervous system arising from the thoracic segments of the spinal cord around the first thoracic nerve. The posterior highly pigmented epithelium and dilator muscle are formed from the neurectoderm, which is the same tissue that makes up the brain and spinal cord. The neuroectoderm, also called neural ectoderm or neural tube epithelium is the portion of the ectoderm, one of the primary germ cell layers in the early embryo, that develops into the central and peripheral nervous systems.



The **Sphincter muscle** is a doughnut shaped muscle that is located beneath the stroma that we often see visible in zone one. We can often see this muscle showing beneath the stroma when the iris fibers are separated and/or less dense in this area. The sphincter muscle is primarily innervated or influenced by the parasymphathetic aspect of the autonomic nervous system that enters the back of the eye through the long ciliary nerves. These nerves arise in the ciliary ganglion behind the eye, and in turn whose branches come from the third cranial nerve and originate in the oculomotor nucleus of the mid-brain. This area reflects the stomach, which is also innervated by the parasymphathetic nervous system. The sphincter muscle has sympathetic enervation as well.

The **Pupillary Zone** is a relatively flat part of the iris that includes zones one and two or the stomach and intestinal reaction fields and surrounds the pupillary ruff or pupillary border. This zone is called the nutritive zone.

The **Ciliary Zone** is an area outside the collarette which includes all of the iris outside the collarette to the iris edge. Within the ciliary zone are 3-4 layers of the iris fibers or trabeculae. These fibers are also called vascular arcades and are blood vessels covered by a collagen sheath. Woven within these iris fibers are layers of connective tissue. There are various iris signs or topographical markings located in the ciliary zone. Inherent deficiencies called contraction furrows or cramp rings may be seen in some irises. Cramp rings are grooves in the iris fibers that look much like ditches that follow underlying patterns of posterior epithelium and furrows of the dilator muscle. The ciliary zone reflects the conditions of all major organs, glands, and systems of the body other than the stomach and gastrointestinal tract.