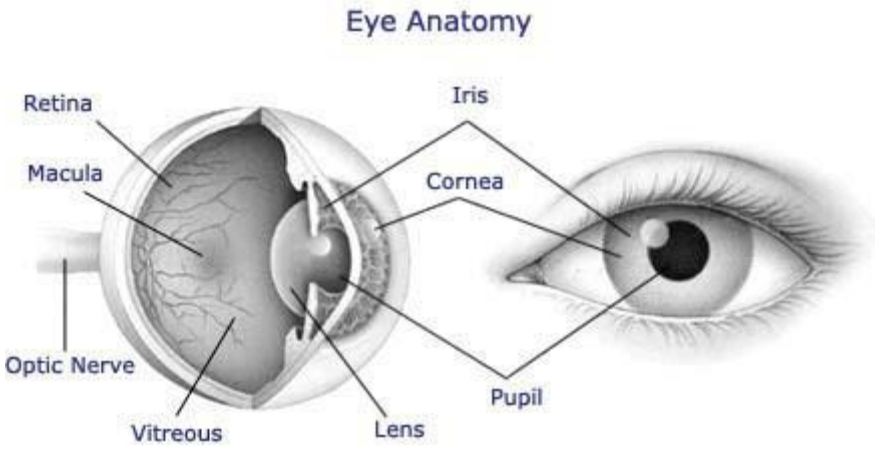
HOW THE EYE WORKS



The Eyes & Vision

Our ability to "see" starts when light reflects off an object and enters the eye. As it enters the eye, the light is unfocused. The first step in seeing is to focus the light rays onto the retina, which is the light sensitive layer found inside the eye. Once the light is focused, it stimulates cells to send millions of electrochemical impulses along the optic nerve to the brain. The portion of the brain at the back of the head interprets the impulses, enabling us to see the object.

The Refraction of Light by the Eye

Light entering the eye is first bent, or refracted, by the cornea -- the clear window on the outer front surface of the eyeball. The cornea provides most of the eye's optical power or light-bending ability.

After the light passes through the cornea, it is bent again -- to a more finely adjusted focus -- by the crystalline lens inside the eye. The lens focuses the light on the retina. This is achieved by the ciliary muscles in the eye. They change the shape of the lens, bending or flattening it to focus the light rays on the retina.

This adjustment in the lens is necessary for bringing near and far objects into focus. The process of bending light to produce a focused image on the retina is called "refraction". Ideally, the light is "refracted" in such a manner that the rays are focused into a precise image on the retina.

Many vision problems occur because of an error in how our eyes refract light. In nearsightedness (myopia), the light rays form an image in front of the retina. In farsightedness (hyperopia), the rays focus behind the retina. In astigmatism, the cornea is shaped like a football instead of a baseball. This causes light rays to focus on more than one plane, so that a single clear image cannot be formed on the retina. As we age, we find reading or performing close-up activities more difficult. This condition is called presbyopia, and it results from the crystalline lens loosing flexibility, and therefore the ability to bend light. Problems related to an eye's inability to effectively refract light can usually be corrected with glasses or contact lenses.

How do we make sense of light?

Sensory interpretation

Even with the light focused on the retina, the process of seeing is not complete. For one thing, the image is inverted, or upside down. Light, from the various "pieces" of the object being observed, stimulate photoreceptors in the retina.

Rods and cones

Two types of photoreceptors -- rods and cones -- are present. Rods are mainly found in the peripheral retina and enable us to see in dim light and to detect peripheral motion. They are primarily responsible for night vision and visual orientation. Cones are principally found in the central retina and provide detailed vision for such tasks as reading or distinguishing distant objects. They also are necessary for color detection. These photoreceptors convert light to electrochemical impulses that are transmitted via the nerves to the brain.

Millions of impulses travel along the nerve fibers of the optic nerve at the back of the eye, eventually arriving at the visual cortex at the back of the brain. Here, the electrochemical impulses are unscrambled and interpreted. The image is re-inverted so that we see the object the right way.

What is 20/20 Vision?

You may be pleased to hear that you have 20/20 vision and think you have perfect vision. But do you? Not necessarily. 20/20 only indicates how sharp or clear your vision is in the distance. Overall vision also includes peripheral awareness or side vision, eye coordination, depth perception, focusing ability, and color vision.

20/20 describes normal visual clarity, measured at a distance of 20 feet from an object. If you have 20/20 vision, you can see clearly at 20 feet what should normally be seen at that distance. If you have 20/100 vision for example, you must be as close as 20 feet to see what a person with normal vision can see at 100 feet.

Why do some people have less than 20/20?

The ability to see objects clearly is affected by many factors. Eye conditions like nearsightedness, farsightedness, astigmatism, or eye diseases influence visual acuity. Most people with vision slightly below 20/20 function very well. Everybody's visual expectations are different and satisfactory vision is far more complex than just being able to see 20/20.