



## Eyes Forward

You can't make sense of the world without your sense organs! Start with your eyes. They send tons of information to your brain. So it's no surprise that you have "built-in" structures to protect them!

You only see about one sixth of your eyeball on your face. The rest of it is inside your skull—safely protected within a deep bowl of skull bone called your eye socket.

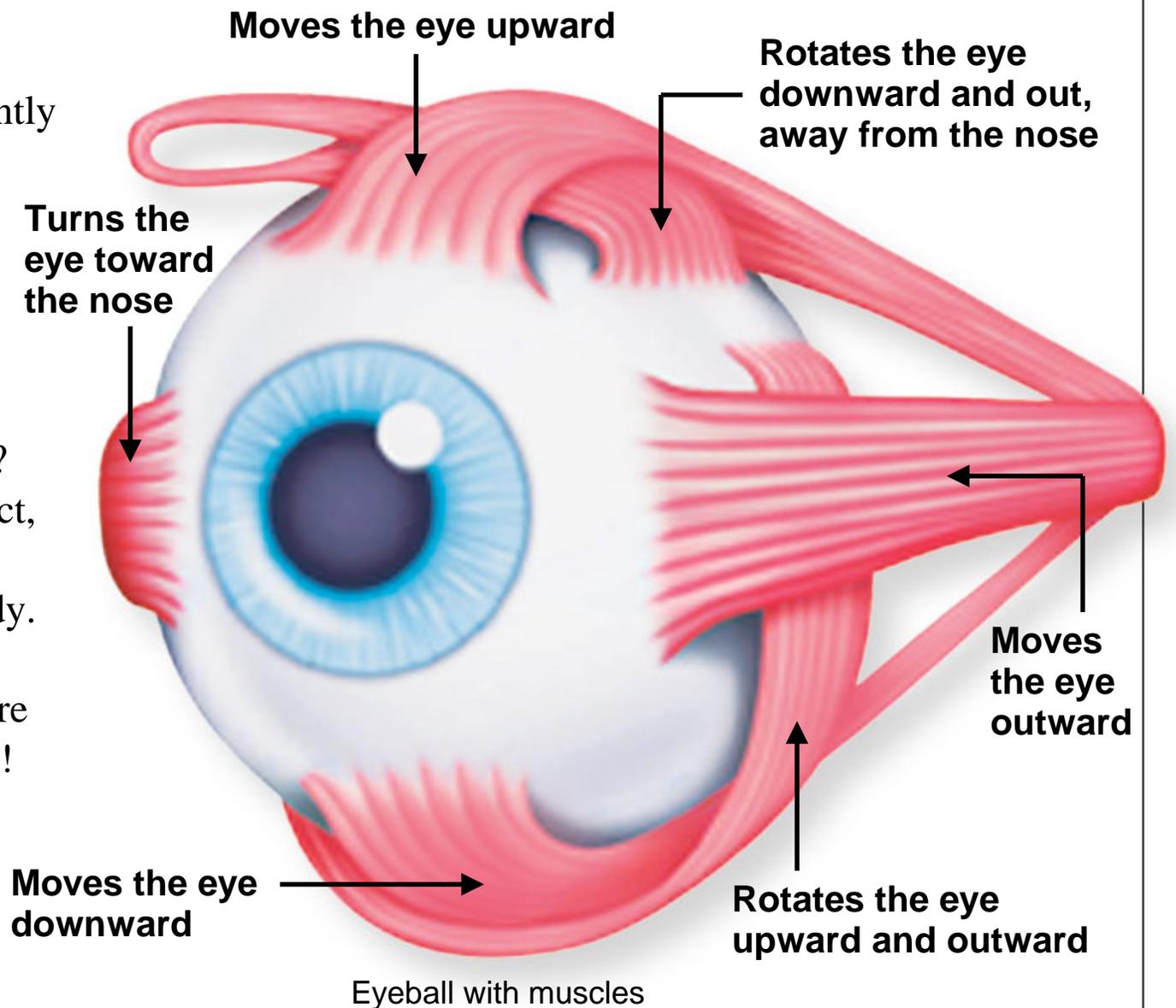




## Moving the Eye

Your eyeballs are constantly moving around in their sockets. Sometimes it's a big movement. Other times, it's just a fraction of an inch.

How do your eyes move? Muscles do the job. In fact, eye muscles are the most used muscles in your body. According to some estimates, they move more than 100,000 times a day!

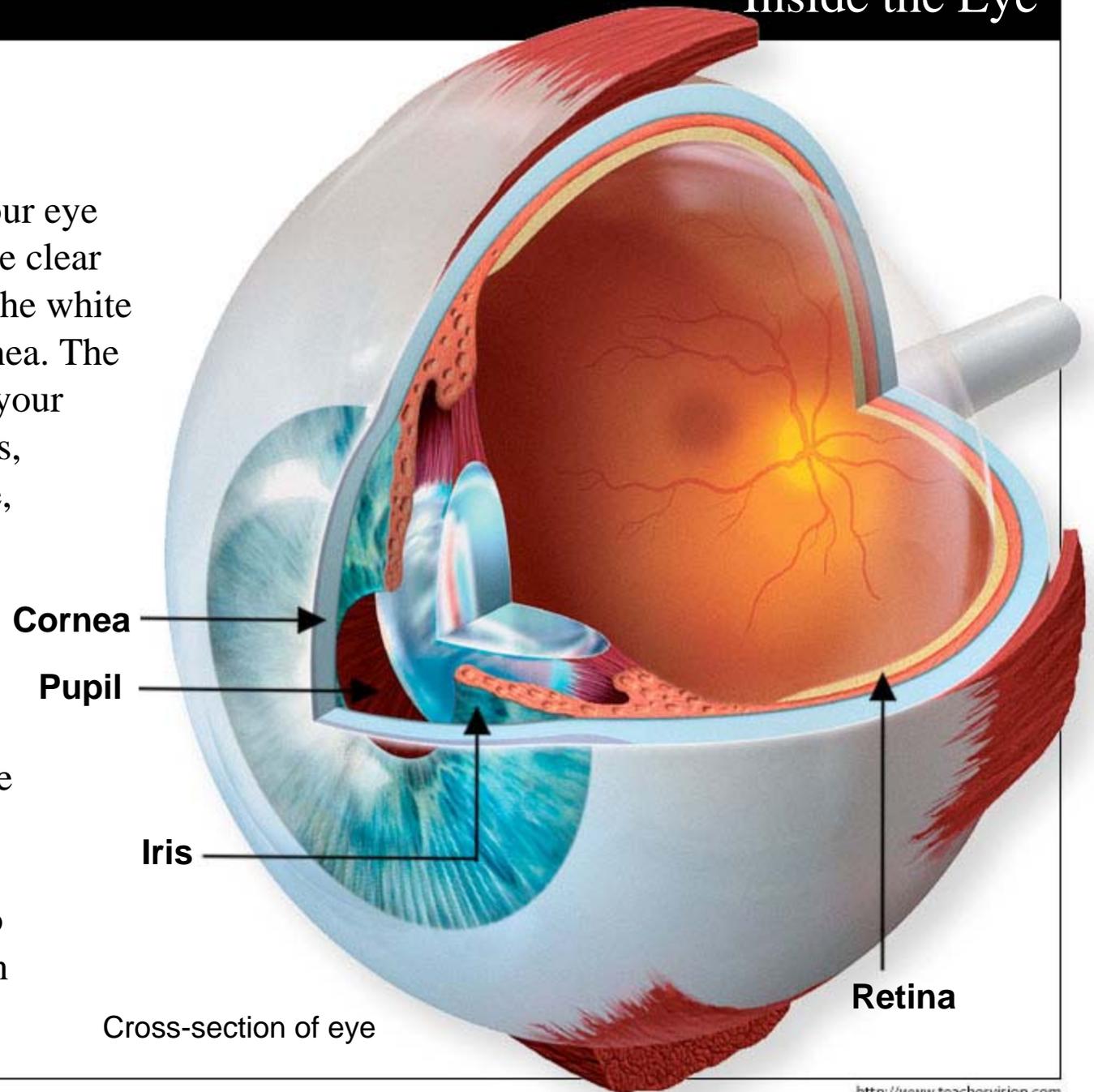




## Inside the Eye

There are some parts of your eye that you can easily see. The clear structure in the middle of the white part of your eye is the cornea. The dark part in the middle of your cornea is the pupil. The iris, or colored part of your eye, controls how much light gets through your pupil.

If you could peer inside to the innermost layer of your eye you would see the retina. The retina contains millions of light-sensitive cells that convert light into electrical impulses that can be sent to the brain.



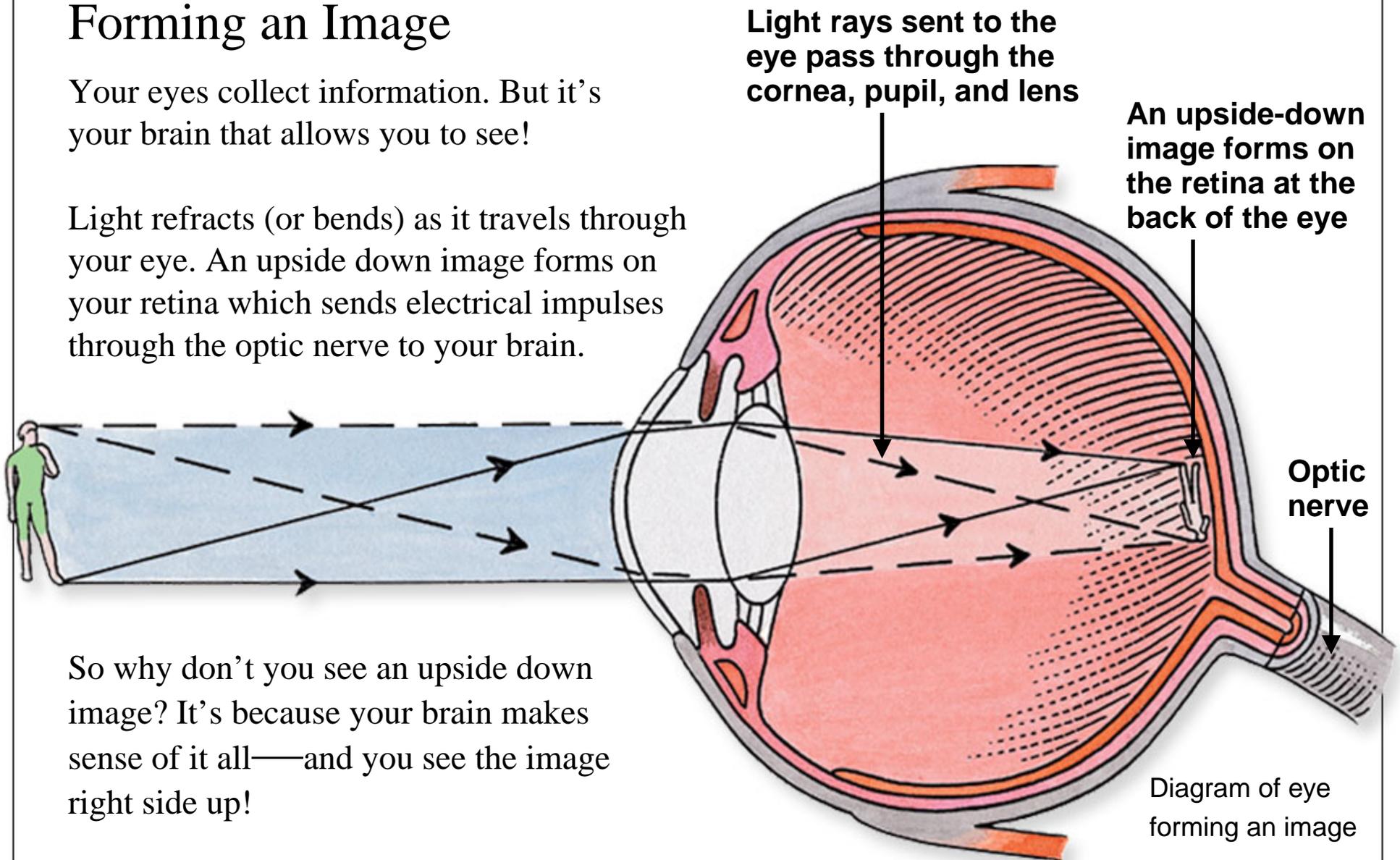


## Forming an Image

Your eyes collect information. But it's your brain that allows you to see!

Light refracts (or bends) as it travels through your eye. An upside down image forms on your retina which sends electrical impulses through the optic nerve to your brain.

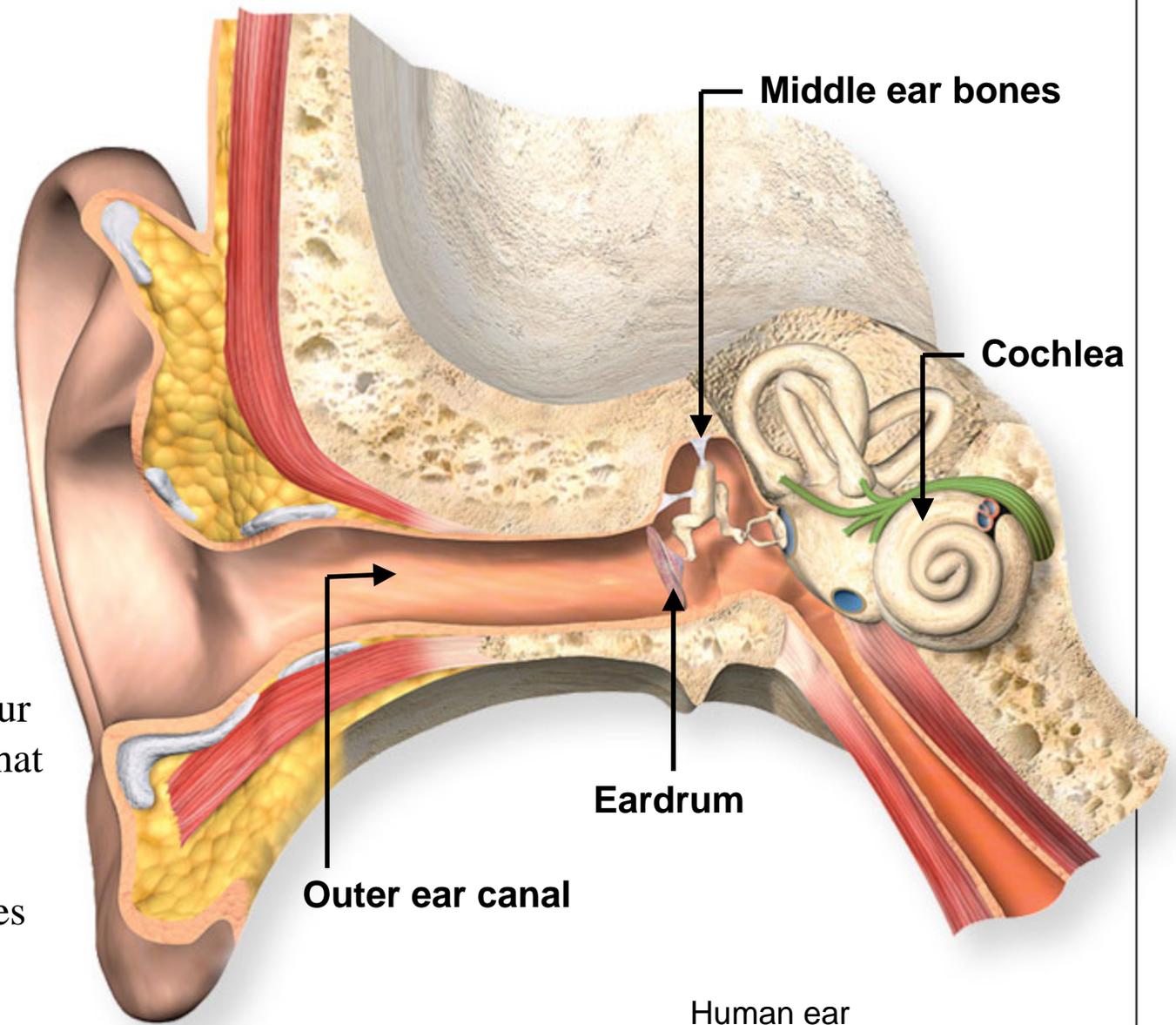
So why don't you see an upside down image? It's because your brain makes sense of it all—and you see the image right side up!





## Inside the Ear

Just like your eye, most of your ear is actually inside your head. The outer ear collects sound waves. These pass through your eardrum causing it to move, or vibrate. These vibrations move through the tiny bones in your middle ear and are passed on to your inner ear. The snail-shaped cochlea in your inner ear contains nerves that take the information to the brain. And you guessed it! The brain then distinguishes between different kinds of sounds.





## Smallest Bones

The bones in your middle ear are the smallest bones in your body. The three bones get their names from the Latin word for their shapes: malleus (hammer), incus (anvil), and stapes (stirrup). The tiny hammer bone you see in this photo is just  $\frac{1}{4}$  inch long—yet you'll hear no sound (large or small) without it!

**Malleus**



Tiny hammer bone on finger

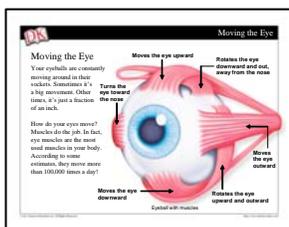


# Sense Organs: Eyes and Ears Teacher Notes



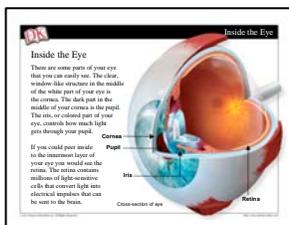
## Eyes Forward

Only one-sixth of an eyeball, including the pupil and iris, can be seen from the outside. The rest of each eyeball sits protected within a deep bowl of skull bone called the eye socket. Eyebrows, eyelids, and eyelashes protect the front of the eye by shading it from dust, sweat, and excessive light. The color of the iris depends on the amount of the brown pigment melanin present. Brown eyes have the most melanin.



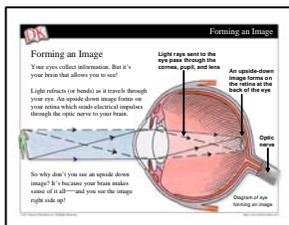
## Moving the Eye

Eyeballs swivel in their sockets to follow moving objects. They also make tiny, jumping movements when scanning a face or the words on a page. The six slim muscles that produce all these movements are attached to the sclera at one end and the skull at the other. The muscles work as a team to move the eye in all directions.



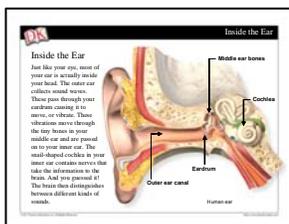
## Inside the Eye

The wall of the eyeball is a three-layered sandwich. Outermost is the tough sclera, visible at the front as the white of the eye, except where the clear cornea allows light in. In the middle is the choroid, which is filled with blood vessels that supply the other two layers. The innermost layer is the light-detecting retina. Its millions of light detecting cells send image information to the brain.



## Forming an Image

When we look at an object, light rays reflected from that object shine through and are partly focused, or bent, by the cornea. The light then passes through the pupil to the lens. Ciliary muscles adjust the lens's shape, and further focus the rays, which projects a sharp upside-down image onto the retina. The retina sends nerve signals along the optic nerve to the brain, which then turns the image the right way up.



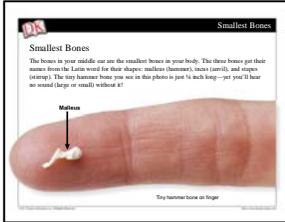
## Inside the Ear

Most of the ear is concealed inside the skull's temporal bone. It has three main parts. The outer ear consists of the pinna (ear flap) that directs sound waves into the ear canal. The air-filled middle ear contains the eardrum and three tiny bones, the ossicles, which convert the sound waves into mechanical movement. The fluid-filled inner ear is made up of the semicircular canals, the vestibule, and the snail-shaped cochlea—the organ that converts sound into nerve signals.

The innermost part of the ear is made up of a maze of channels inside the temporal bone. These channels are lined with membranes and filled with fluid. One branch of the inner ear leads to the coiled cochlea. The vestibule contains two organs of balance, the utricle and saccule. It also houses the oval window, the membrane through which sound vibrations pass from middle to inner ears. Another balance organ, the semicircular canals, lies above the vestibule.



# Sense Organs: Eyes and Ears Teacher Notes



## Smallest Bones

The ossicles spanning the middle ear are the smallest bones in the body. They get their Latin names from their shapes: malleus (hammer), incus (anvil), and stapes (stirrup). Attached to the bones are two of the body's smallest muscles, the tensor tympani and the stapedius. If a very loud sound reaches the eardrum, these muscles contract. They damp down the eardrum's movements, and their own, to prevent intense vibrations from damaging the delicate inner ear.

The ossicles (ear bones) are tiny. The malleus (hammer) is shown here actual size. It is just over 1/4 inch (8 mm) long, almost twice the size of the stapes (stirrup).