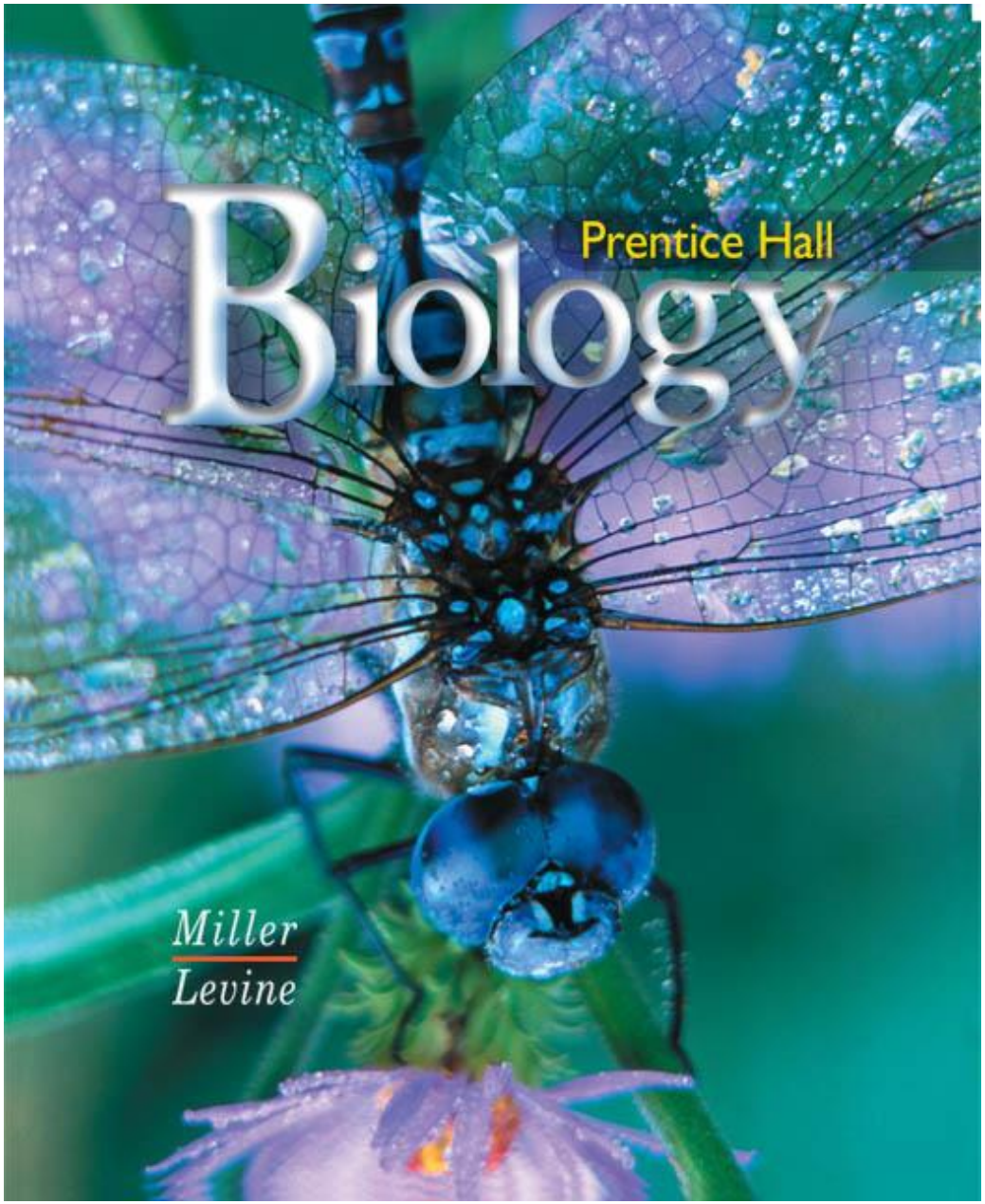

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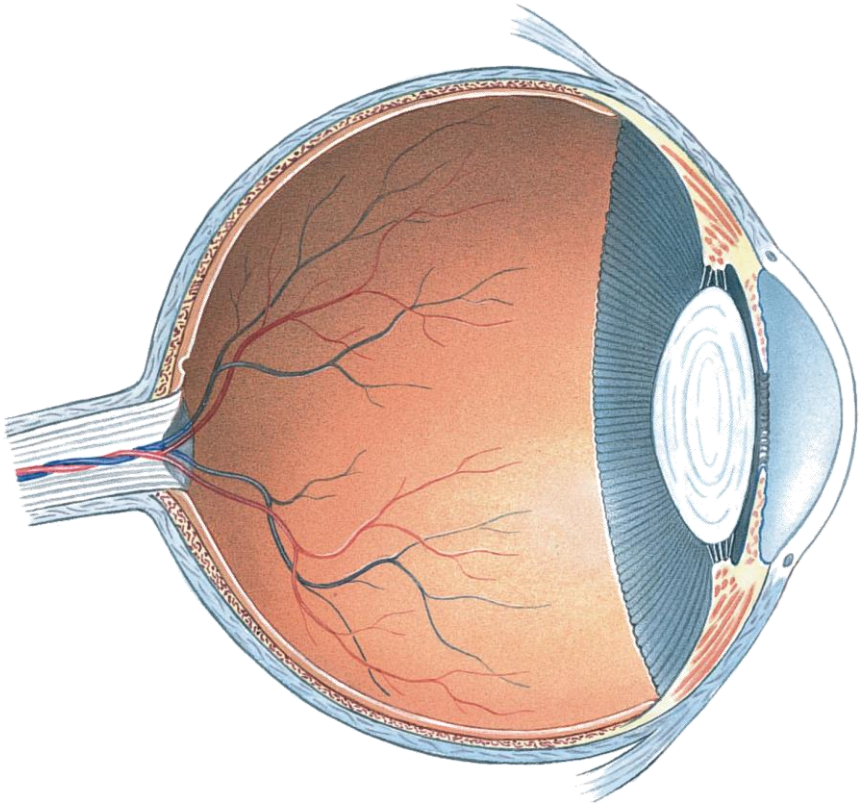
35–4 The Senses



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Neurons that react directly to stimuli from the environment are called **sensory receptors**.

Sensory receptors react to stimuli by sending impulses to other neurons and to the central nervous system.

Sensory receptors are located throughout the body but are concentrated in the sense organs.

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These sense organs include the:

- eyes
- ears
- nose
- mouth
- skin

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What are the five types of sensory receptors?

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There are five general categories of sensory receptors:

- pain receptors
- thermoreceptors
- mechanoreceptors
- chemoreceptors
- photoreceptors

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Pain receptors are located throughout the body except in the brain.

They respond to chemicals released by damaged cells.

Pain usually indicates danger, injury, or disease.

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Thermoreceptors are located in the skin, body core, and hypothalamus.

They detect variations in temperature.

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Mechanoreceptors are found in the skin, skeletal muscles, and inner ears.

They are sensitive to touch, pressure, stretching of muscles, sound, and motion.

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Chemoreceptors, located in the nose and taste buds, are sensitive to chemicals in the external environment.

Photoreceptors, found in the eyes, are sensitive to light.

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Vision

The sense organ that animals use to sense light is the eye.

The eye has three layers:

- the retina
- the choroid
- the sclera

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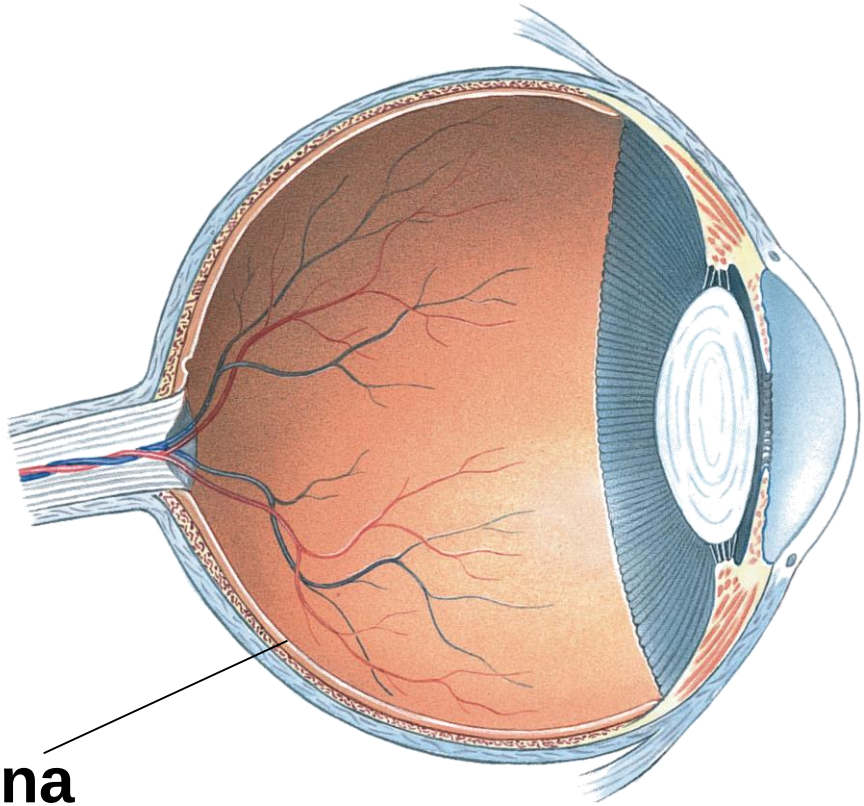
The retina is the inner layer of eye that contains photoreceptors.



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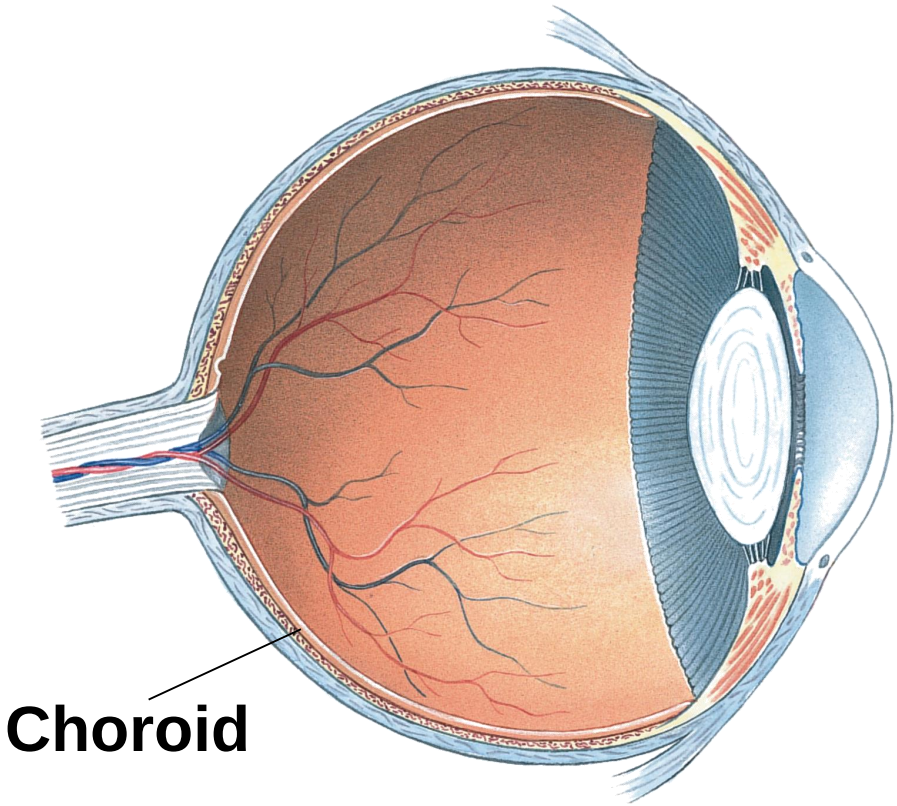
The choroid is the middle layer of eye that is rich in blood vessels.



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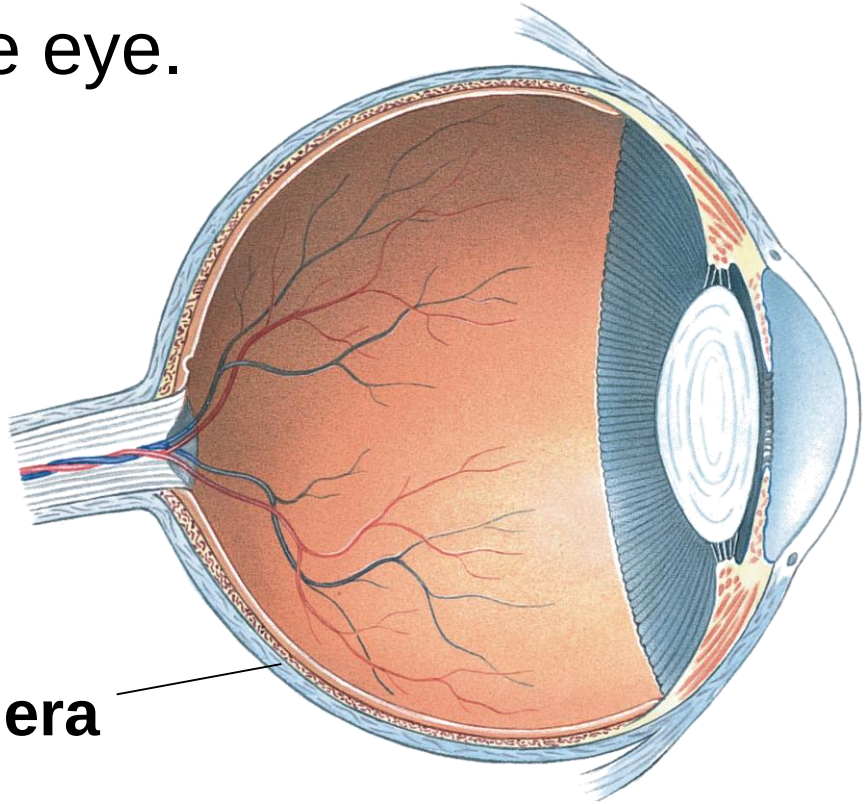
The sclera is the outer layer of eye that maintains its shape.

The sclera serves as point of attachment for muscles that move the eye.



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35–4 The Senses ➡ Vision

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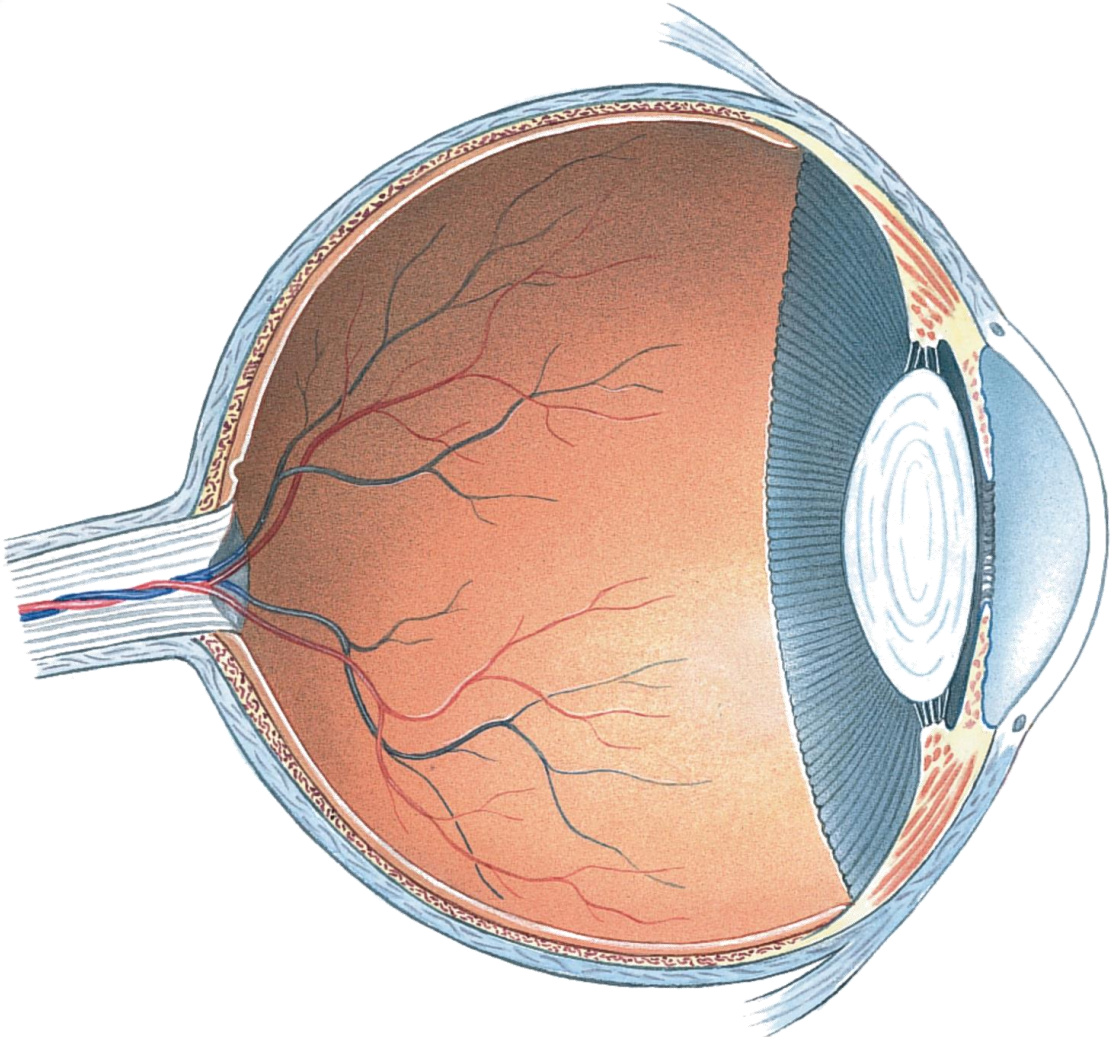

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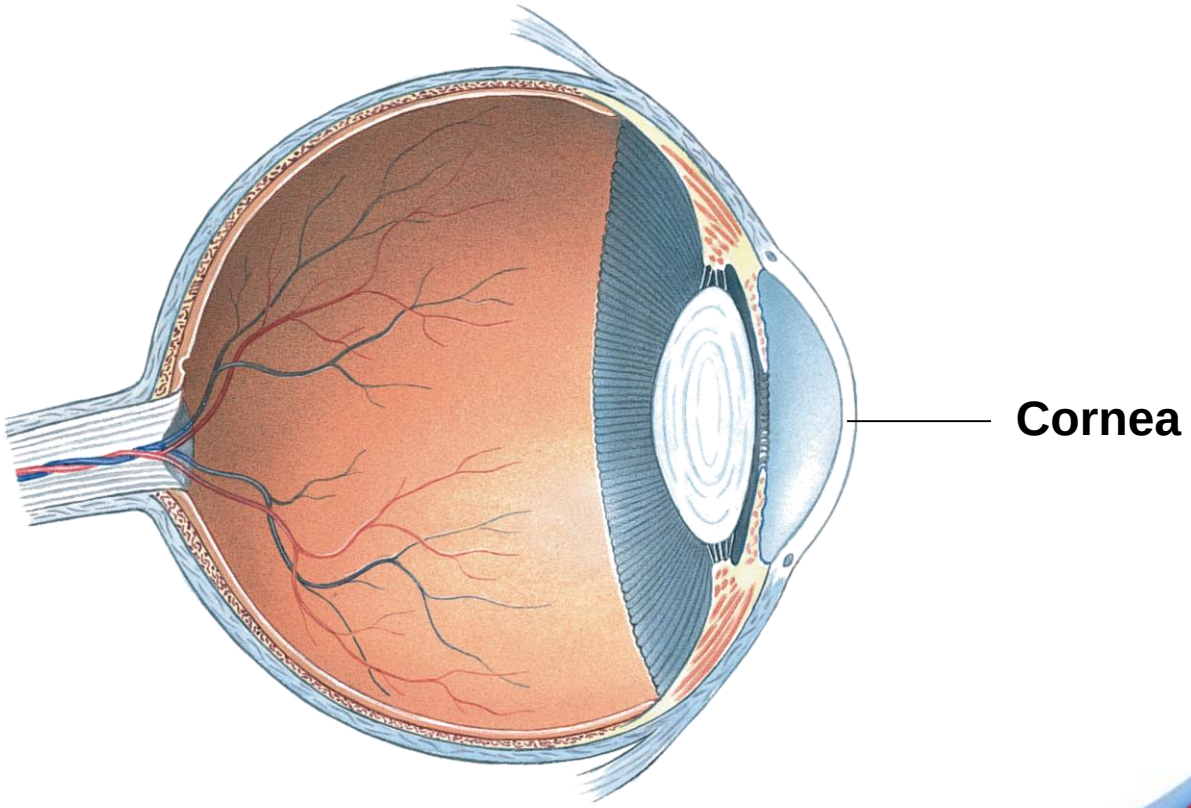
Light enters the eye through the cornea, a tough transparent layer of cells.



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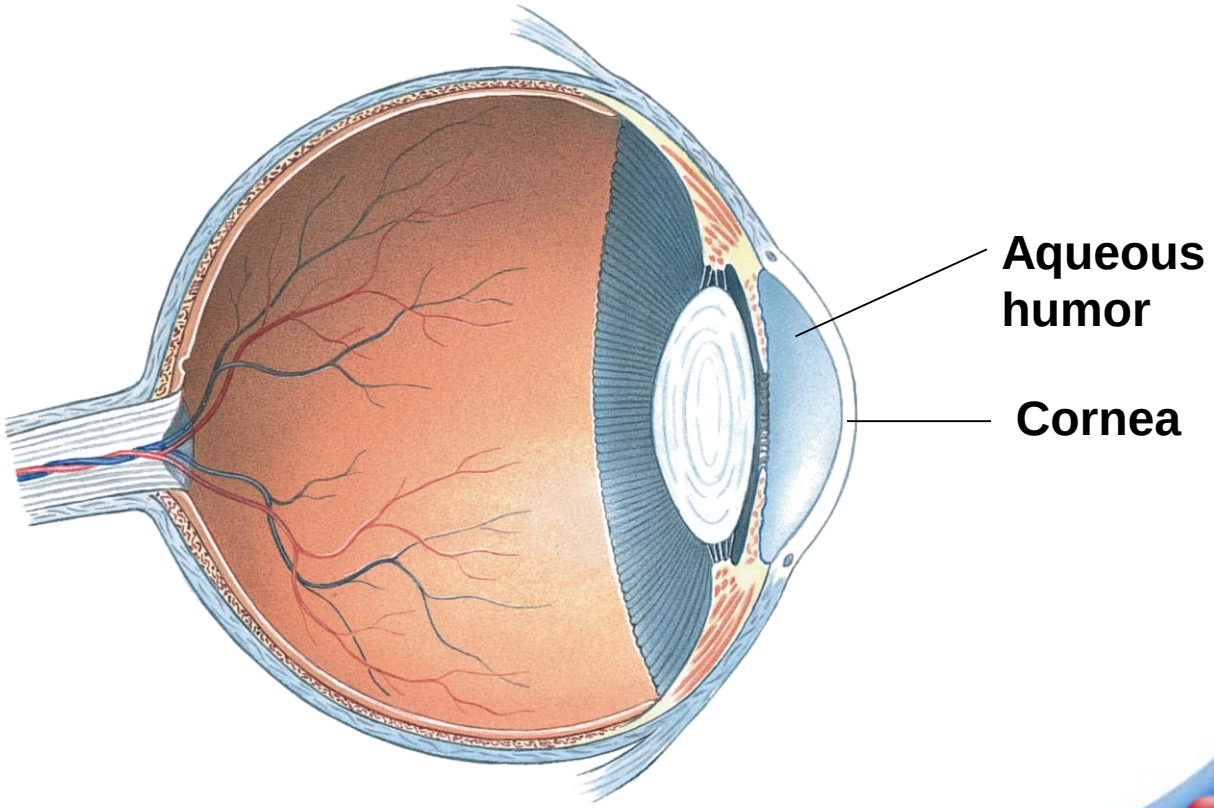
The cornea helps focus light, which then passes through a chamber filled with a fluid called aqueous humor.



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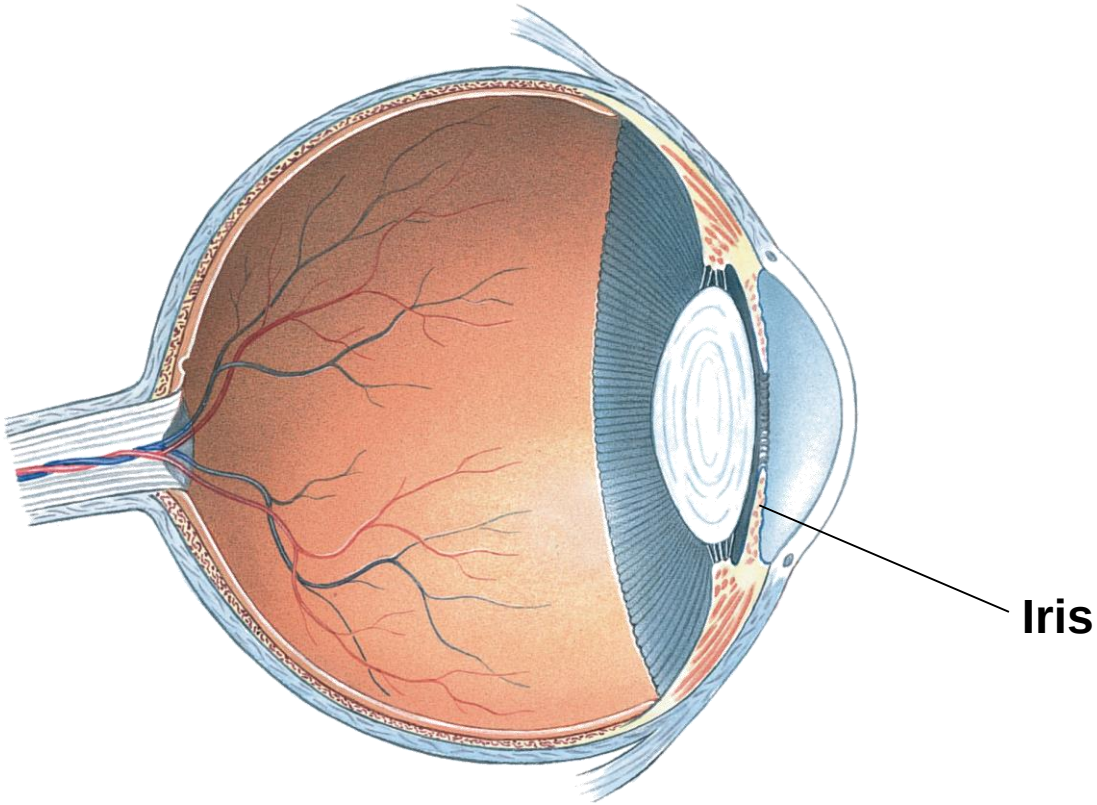
At the back of the chamber is a disklike structure called the iris, which is the colored part of the eye.



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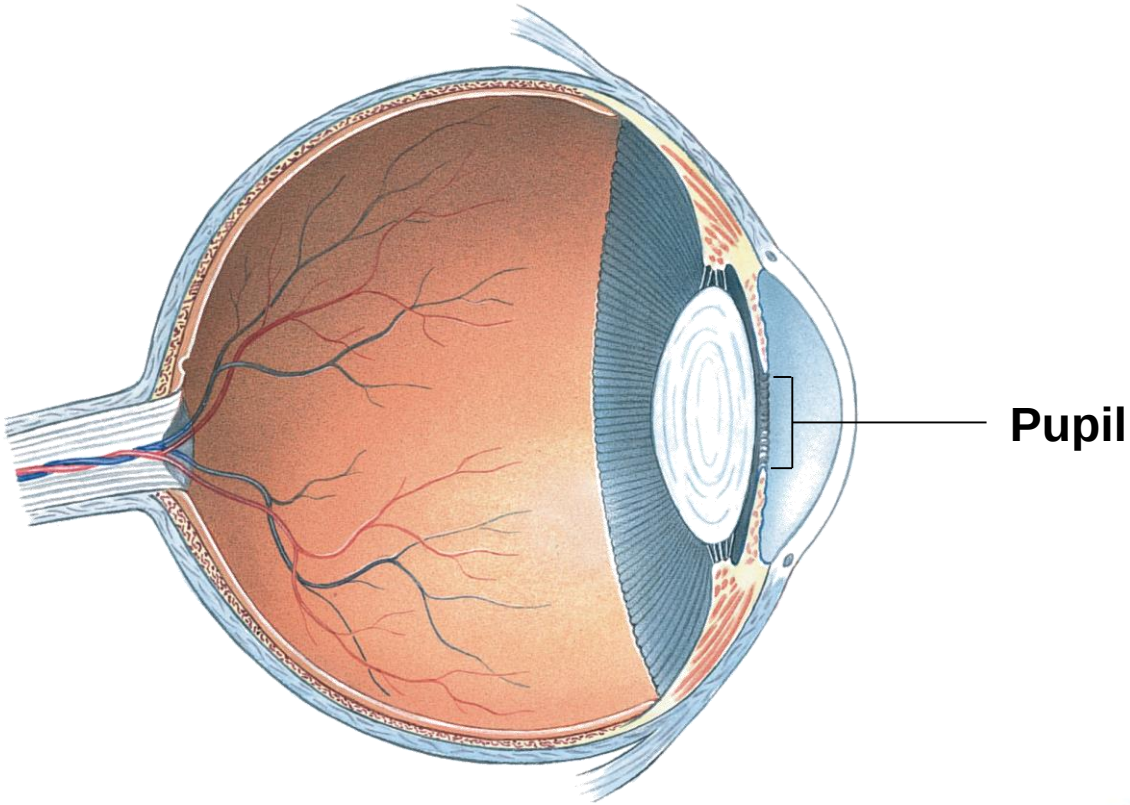
In the middle of the iris is a small opening called the pupil. Muscles in the iris adjust pupil size to regulate the amount of light that enters the eye.



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In dim light, the pupil becomes larger.

In bright light, the pupil becomes smaller.

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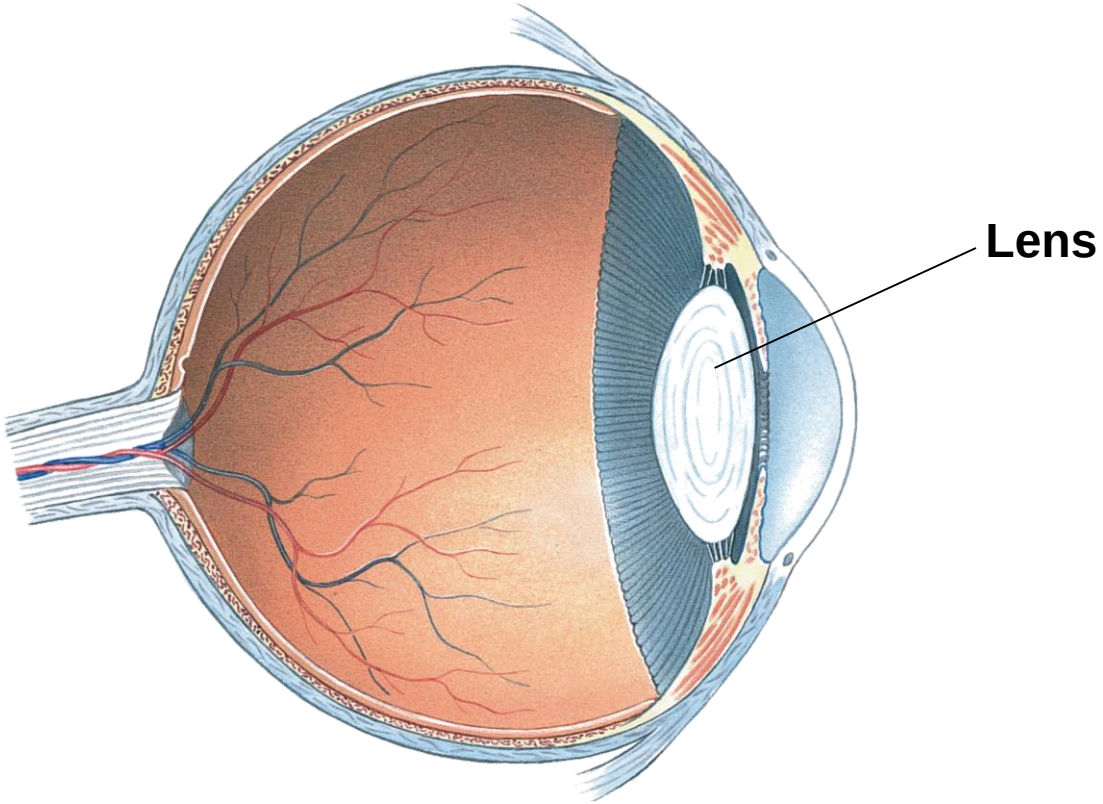
Just behind the iris is the **lens**.

Muscles attached to the lens change its shape to adjust focus to see near or distant objects.



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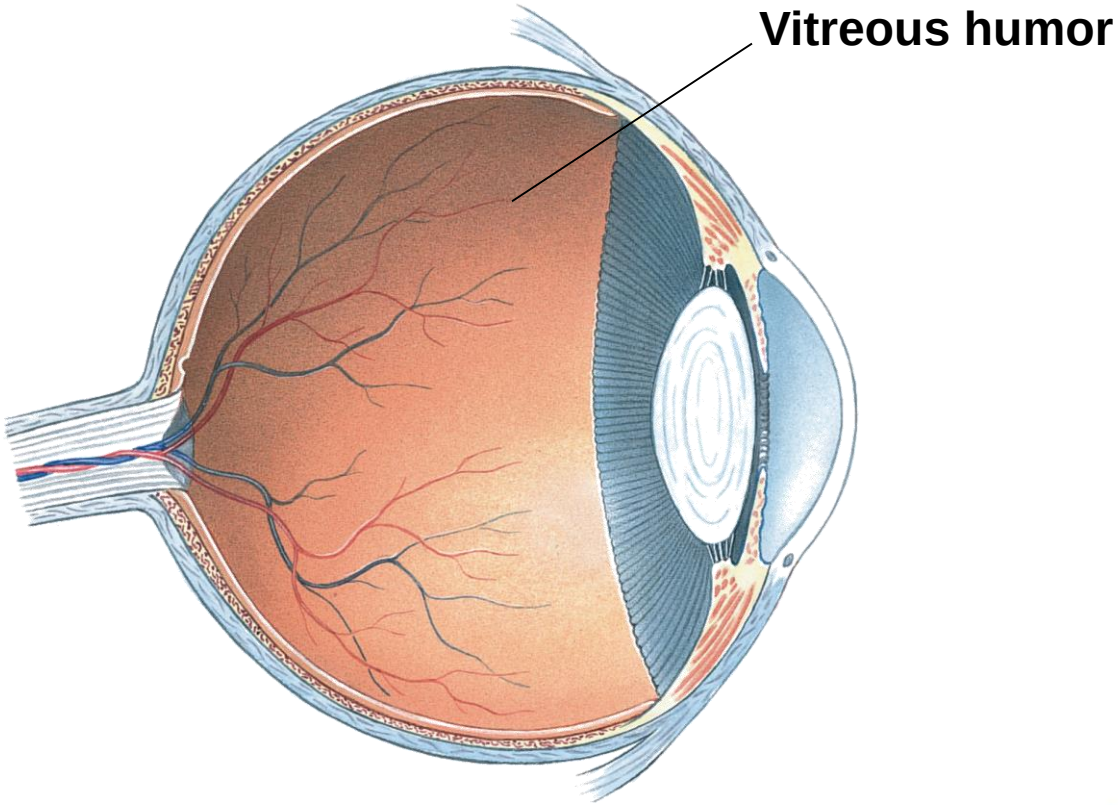
Behind the lens is a large chamber filled with a transparent, jellylike fluid called vitreous humor.



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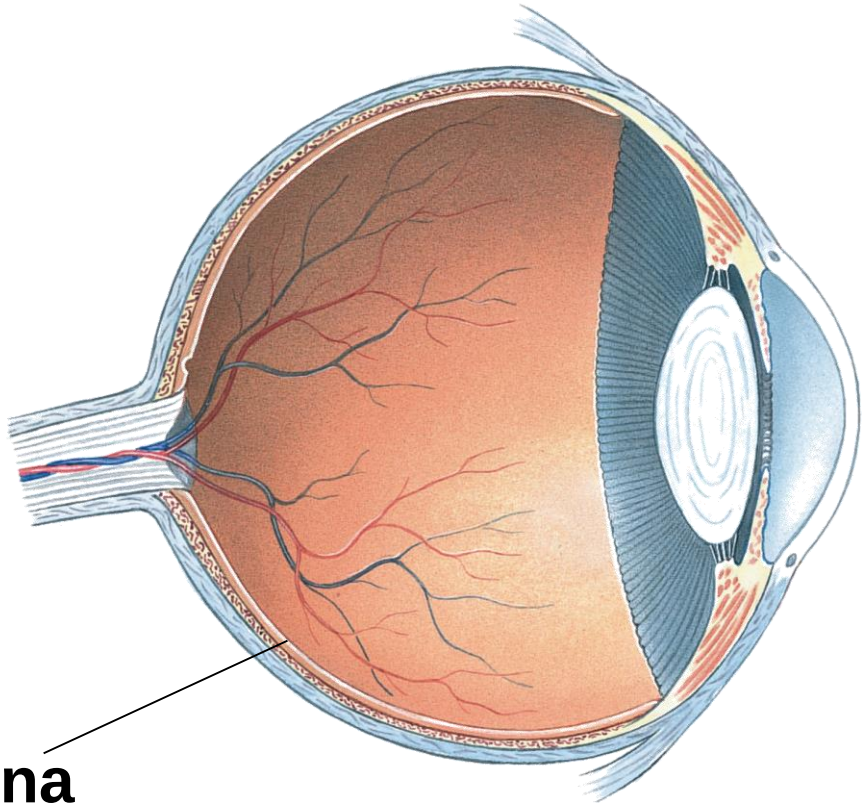
The lens focuses light onto the **retina**.

Photoreceptors are arranged in a layer in the retina.



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The photoreceptors convert light energy into nerve impulses that are carried to the central nervous system.

There are two types of photoreceptors: rods and cones.

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Rods are sensitive to light, but not color.

Cones respond to light of different colors, producing color vision.

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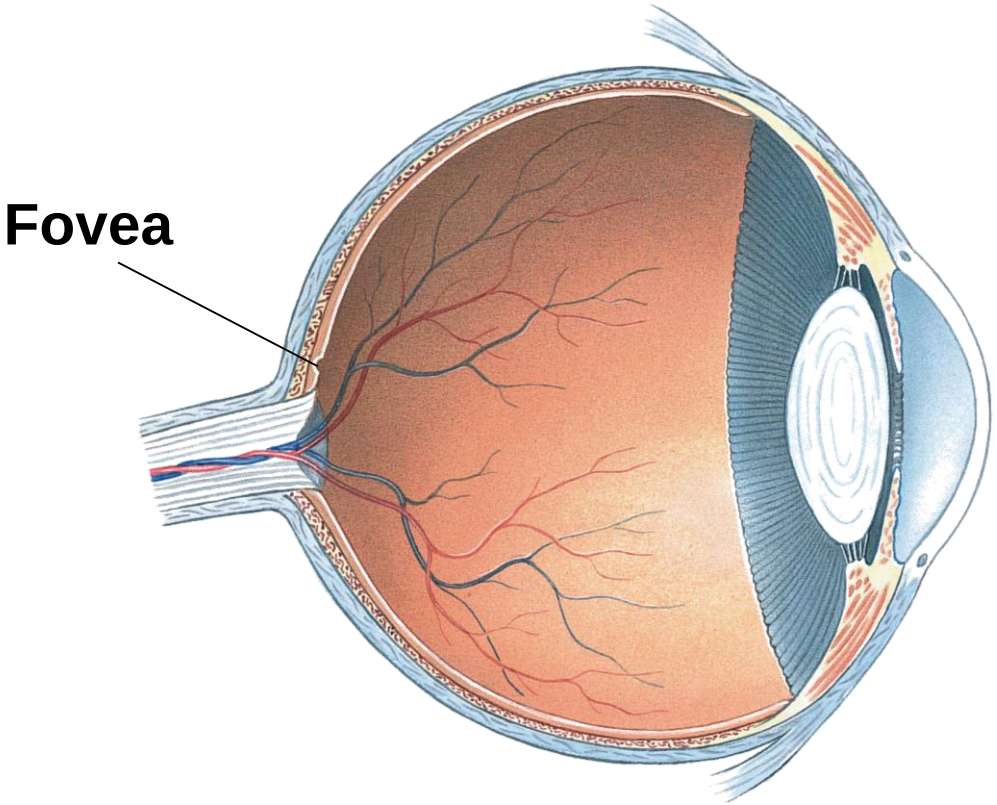
Cones are concentrated in the fovea, which is the site of sharpest vision.



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There are no photoreceptors where the optic nerve passes through the back of the eye, which is called the blind spot.

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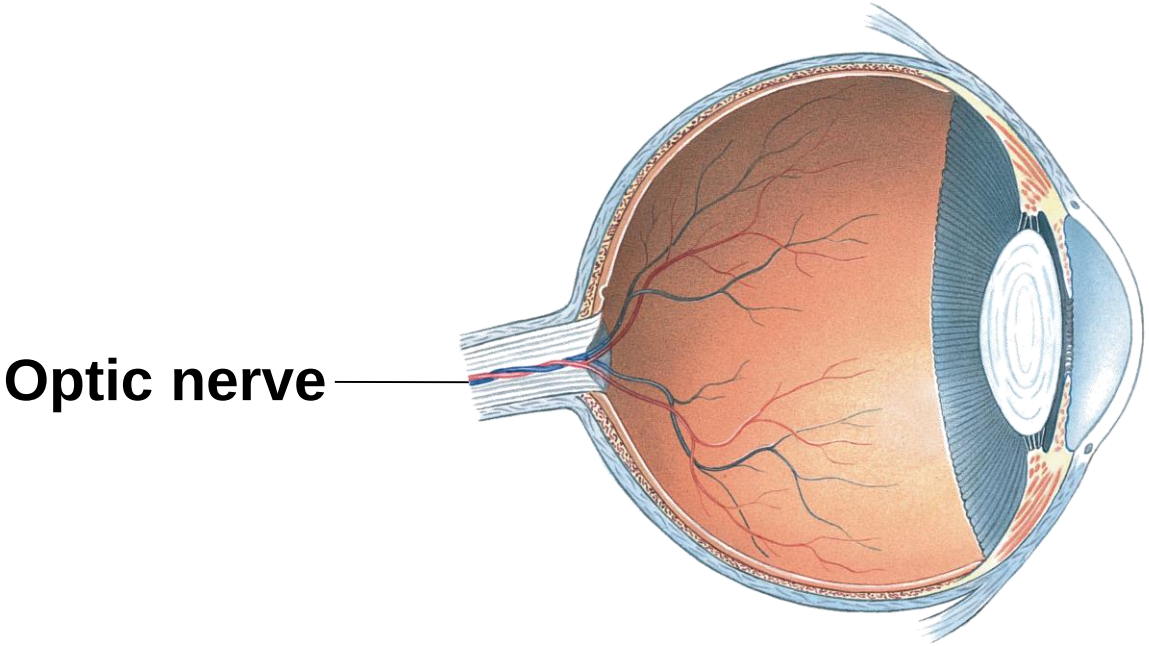
The impulses leave each eye by way of the optic nerve. Optic nerves carry impulses to the brain.

The brain interprets them as visual images and provides information about the external world.



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The Ear

The human ear has two sensory functions:

- hearing
- balance

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Hearing

Ears can distinguish both the pitch and loudness of those vibrations.

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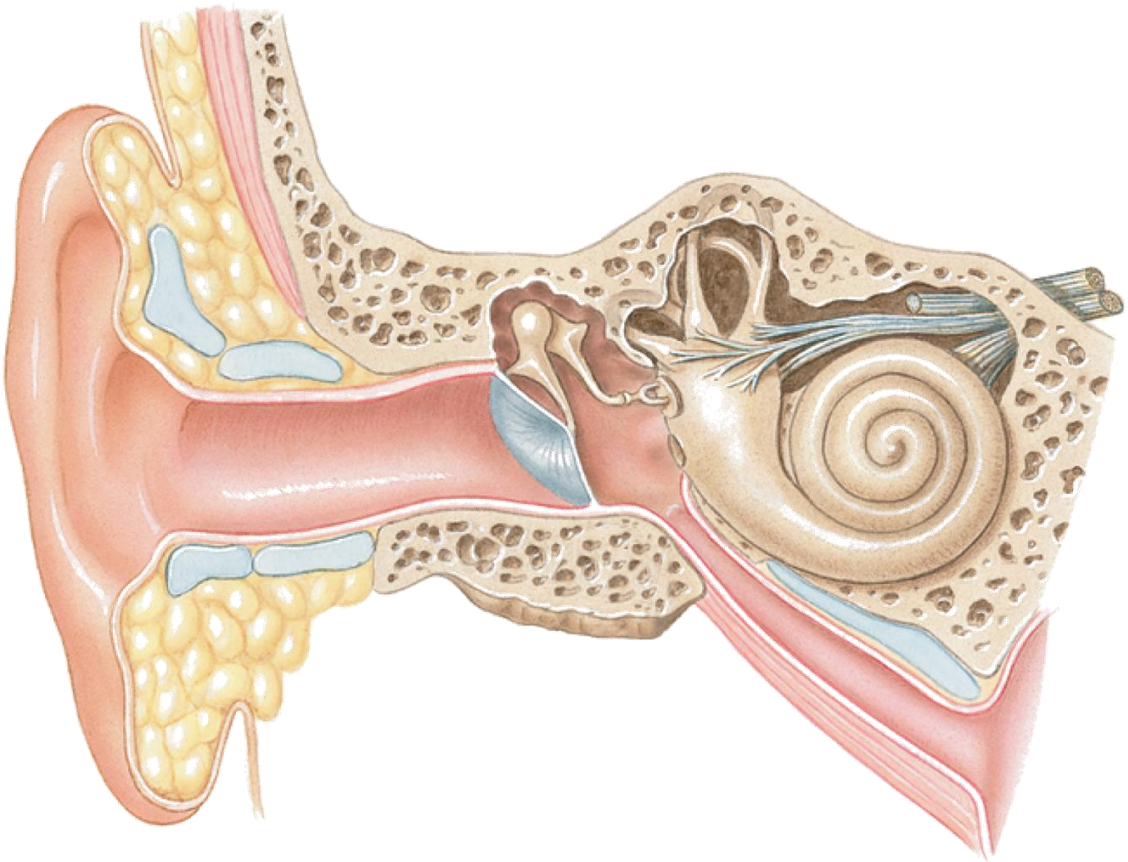
The Human Ear



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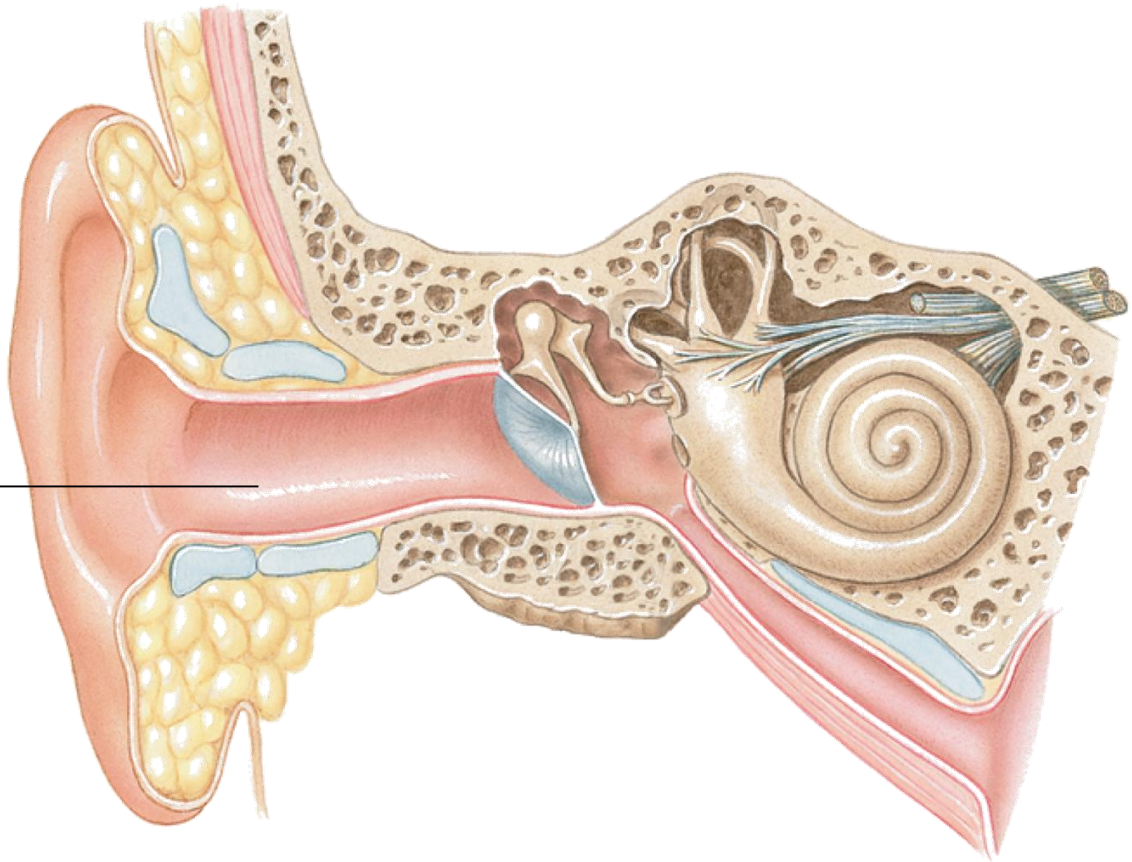
Vibrations enter the ear through the auditory canal.

Auditory canal



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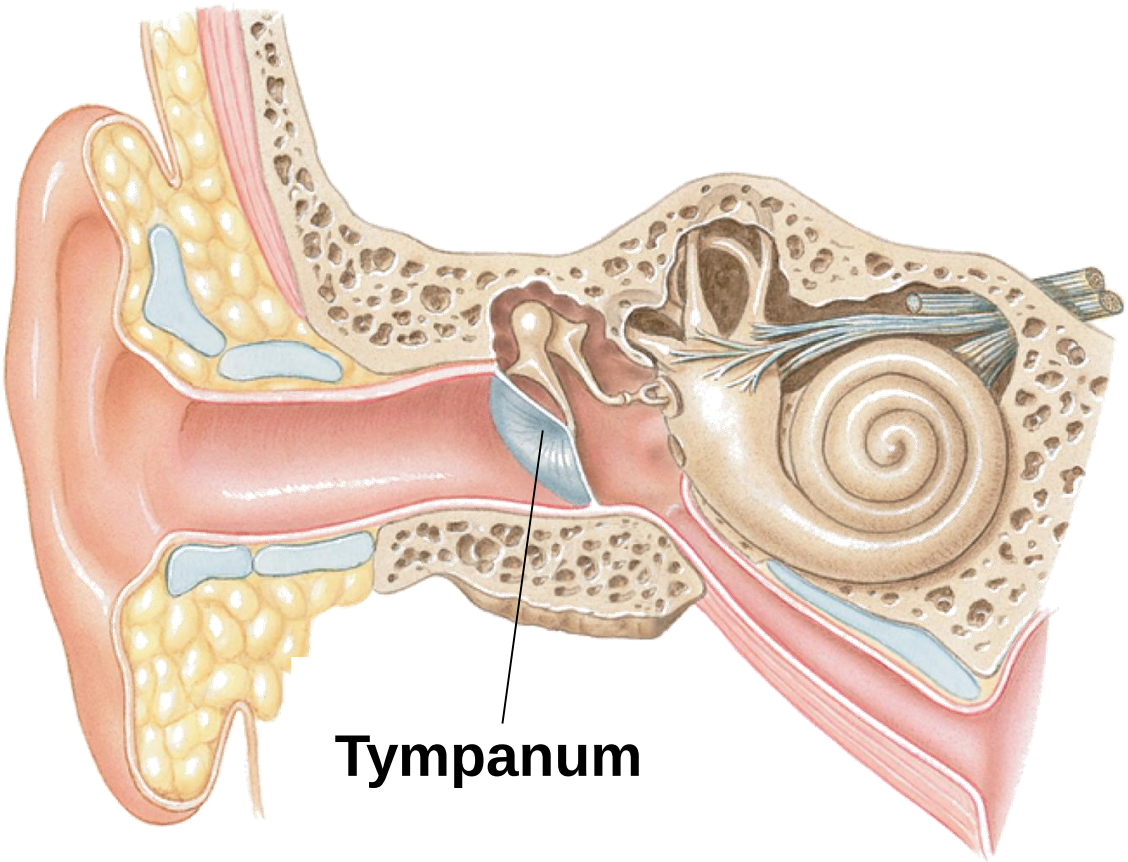
The vibrations cause the tympanum, or eardrum, to vibrate.



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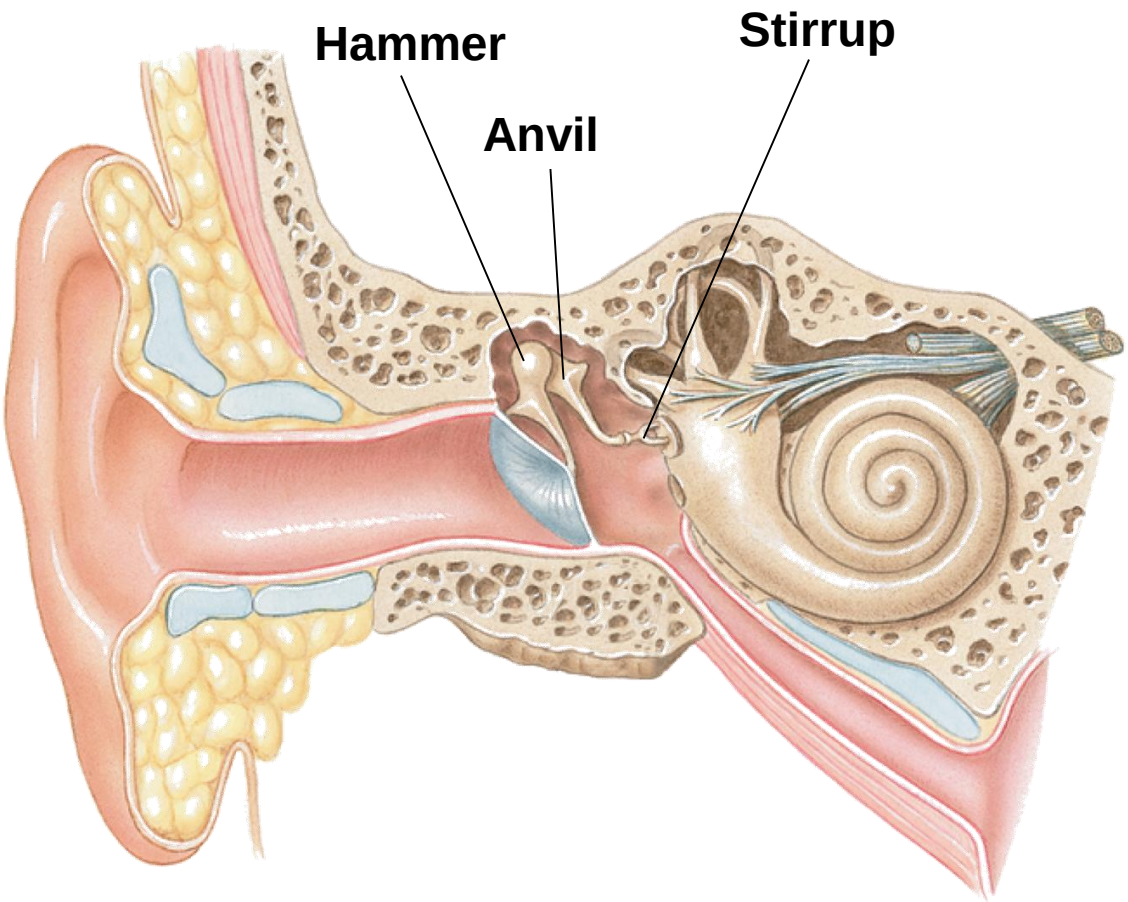
The vibrations are picked up by the hammer, anvil, and stirrup.



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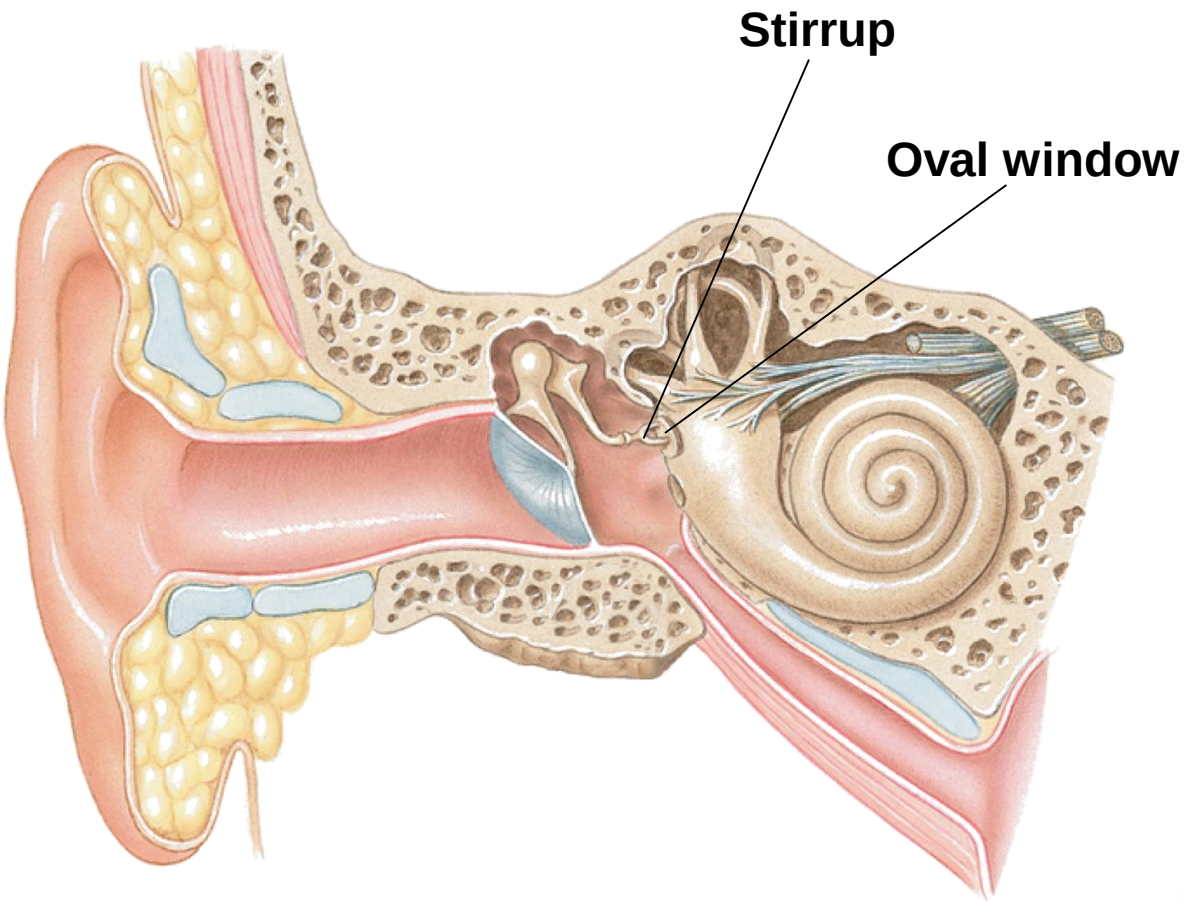
The stirrup transmits the vibrations to the oval window.



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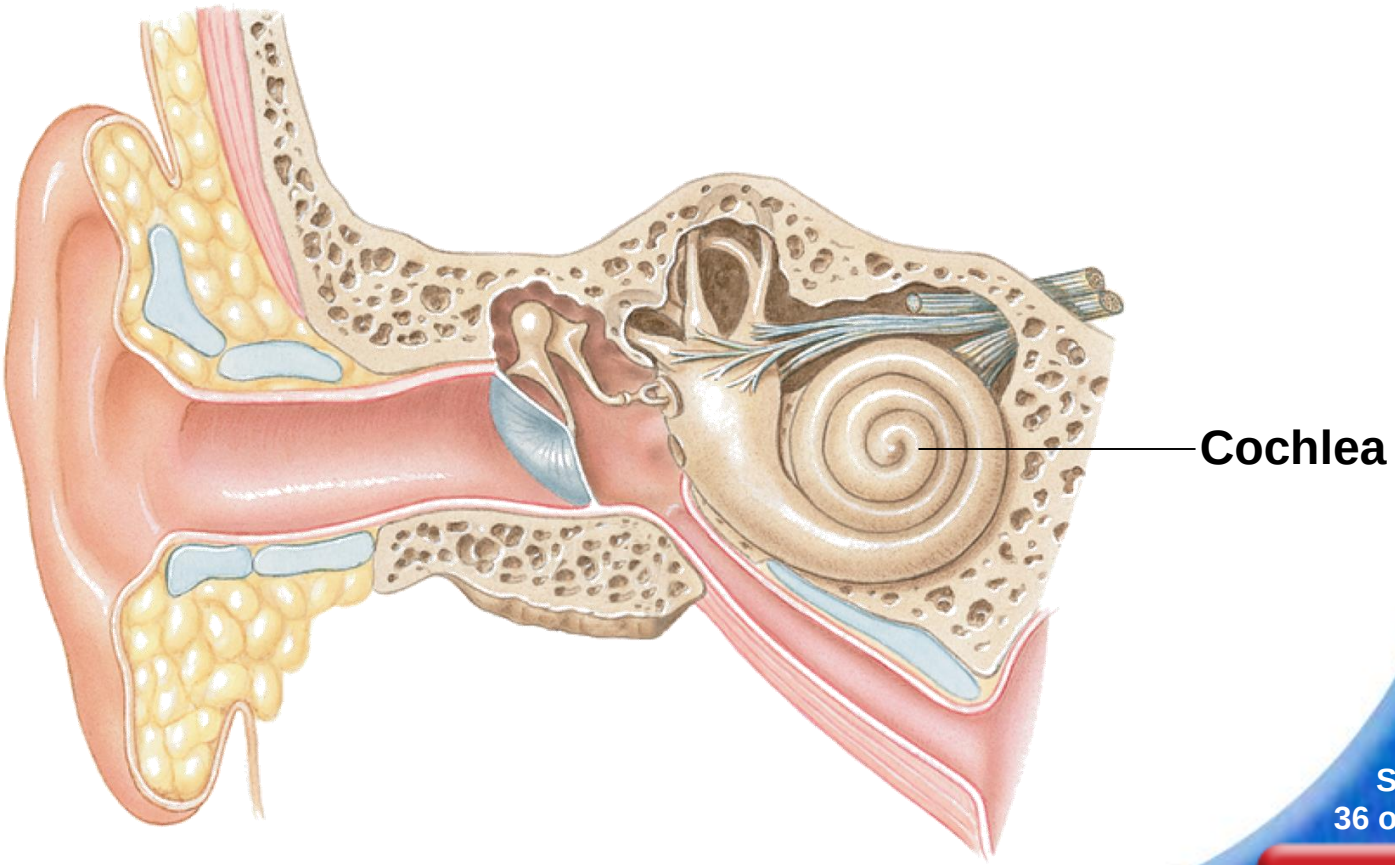
Vibrations of the oval window create pressure waves in the fluid-filled **cochlea** of the inner ear.



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The cochlea is lined with tiny hair cells that are pushed back and forth by these pressure waves.

In response to the waves, the hair cells produce nerve impulses that are sent to the brain through the cochlear nerve.

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Balance

Your ears help you to maintain your balance, or equilibrium.

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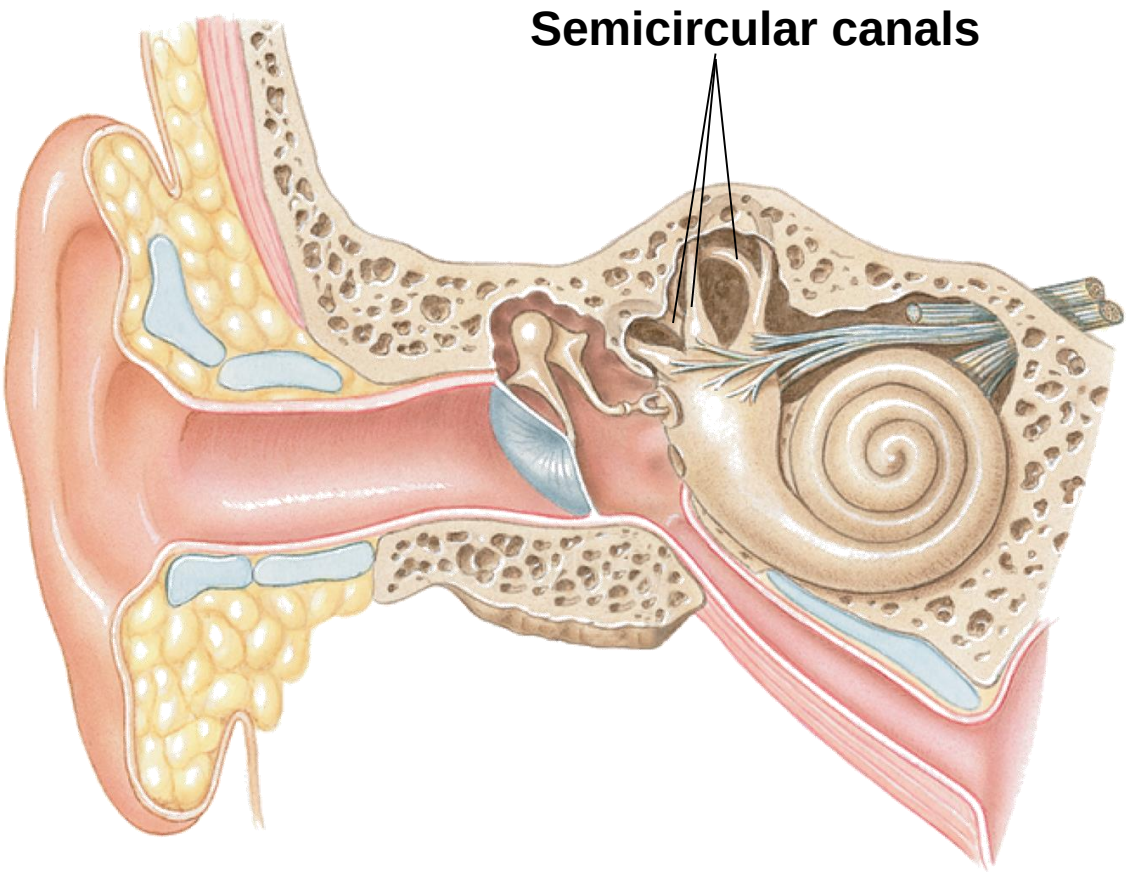
Within the inner ear, just above the cochlea are three **semicircular canals**.



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The canals are filled with fluid and lined with hair cells.

As the head changes position, fluid in the canals changes position, causing the hair on the hair cells to bend.

This sends impulses to the brain that enable it to determine body motion and position.

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Smell

The sense of smell is actually an ability to detect chemicals.

Chemoreceptors in the nasal passageway respond to chemicals and send impulses to the brain through sensory nerves.

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Taste

The sense of taste is also a chemical sense.

The sense organs that detect taste are the **taste buds**. Most taste buds are on the tongue.

Tastes detected by the taste buds are classified as salty, bitter, sweet, and sour.

Sensitivity to these tastes varies on different parts of the tongue.

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Touch and Related Senses

The skin's sensory receptors respond to temperature, touch, and pain.

Not all parts of the body are equally sensitive to touch, because not all parts have the same number of receptors.

The greatest density of sensory receptors is found on your fingers, toes, and face.

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35–4 Section QUIZ

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Section QUIZ

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1 The sensory receptor that detects variations in body temperature is a

a. chemoreceptor.

b. mechanoreceptor.

A c. thermoreceptor.

d. photoreceptor.

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2 The part of the eye containing tiny muscles that adjust the size of the pupil is the

a. cornea.

A b. iris.

c. lens.

d. retina.

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3 The part of the ear that produces the nerve impulses sent to the brain is the

a. tympanum.

b. Eustachian tube.

A c. cochlea.

d. oval window.

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4 The structures in your ears that help maintain your sense of balance

a. is the auditory canal.

b. is the hammer.

c. is the tympanum.

A d. are the semicircular canals.

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5 Photoreceptors in the eye that are sensitive to color are

a. rods.

A b. cones.

c. rods and cones.

d. the optic nerve.

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