Anatomy

The human inner ear contains two divisions: the hearing (auditory) component— the cochlea, and a balance (vestibular) component—the peripheral vestibular system. Peripheral in this context refers to a system that is outside of the central nervous system (brain and brainstem). The peripheral vestibular system sends information to the brain and brainstem.

The vestibular system in each ear consists of a complex series of passageways and chambers within the bony skull. Within these passageways are tubes (semicircular canals), and sacs (a utricle and saccule), filled with a fluid called endolymph. Around the outside of the tubes and sacs is a different fluid called perilymph. Both of these fluids are of precise chemical compositions, and they are different. The mechanism that regulates the amount and composition of these fluids is important to the proper functioning of the inner ear.

Each of the semicircular canals is located in a different spatial plane. They are located at right angles to each other and to those in the ear on the opposite side of the head. At the base of each canal is a swelling (ampulla) and within each ampulla is a sensory receptor (cupula).

Movement and balance

With head movement in the plane or angle in which a canal is positioned, the endolymphatic fluid within that canal, because of inertia, lags behind. When this fluid lags behind, the sensory receptor within the canal is bent. The receptor then sends impulses to the brain about movement.

When the vestibular apparatus on both sides of the head are functioning properly, they send symmetrical impulses to the brain. That is, the impulses coming from the right side conform to (agree with) the impulses coming from the left side.

In response to the nerve impulses from the peripheral vestibular system, the brain sends commands to the eyes—enabling clear vision during movement and to the muscles of the body—so that balance is maintained during position changes and movement.
auditory: related to the sense of hearing.

canalithiasis: the theory of BPPV, where free-floating debris can migrate into a semicircular canal and cause short episodes of vertigo when it moves within the canal.

central vestibular system: parts of the central nervous system (brain and brainstem) that process information from the peripheral vestibular system about balance and spatial orientation.

cochlea: portion of the inner ear concerned with hearing.

cochlear implant: a prosthetic device that, unlike hearing aids which amplify sound, bypass the outer, middle, and inner ear and directly stimulate auditory nerve fibers.
**conductive hearing loss:** hearing loss produced by abnormalities of the outer ear or middle ear. These abnormalities create a hearing loss by interfering with the transmission of sound from the outer ear to the inner ear.

**cupulolithiasis:** a variant of BPPV in which the debris is stuck to the cupula of a semicircular canal rather than being loose within the canal.

**disequilibrium:** unsteadiness, imbalance, or loss of equilibrium; often accompanied by spatial disorientation (a sensation of not knowing where one's body is in relation to the vertical and horizontal planes).

**dizziness:** lightheadedness; does not involve a rotational component (see vertigo).

**endolymph:** the fluid within the semicircular canals and vestibule (utricle and saccule).

**Eustachian tube:** connects the middle ear space with the throat; maintains equal air pressure on both sides of the tympanic membrane (eardrum).

**labyrinth:** complex system of chambers and passageways of the inner ear; includes both the hearing and balance portions of the inner ear.

**labyrinthitis:** an inflammation of the labyrinth.

**middle ear:** air-filled cavity containing the ossicles and tympanic membrane, the function of which is to transfer sound energy from the outer ear to the cochlea of the inner ear.

**mixed hearing loss:** hearing loss produced by abnormalities in both the conductive and sensorineuronal mechanisms of hearing.

**nystagmus:** involuntary, alternating, rapid and slow movements of the eyeballs.

**ossicles (incus, malleus, stapes):** tiny bones of the middle ear that conduct sound from the tympanic membrane to the oval window of the inner ear.

**otoliths:** calcium carbonate crystals found in the utricle and saccule of the inner ear. Damage to the otoliths may lead to BPPV.

**oval window:** oval-shaped opening from the middle ear into the inner ear. The footplate of the stapes fits into the oval window.

**perilymph:** the fluid that fills the space between the semicircular canals and vestibule (utricle and saccule) and the surrounding bone.

**peripheral vestibular system:** parts of the inner ear concerned with balance and body orientation; consists of the semicircular canals, utricle, and saccule. Peripheral in this context means outside the central nervous system (brain and brainstem), to which the peripheral system sends information.

**perilymph fistula:** abnormal opening that permits perilymph from the inner ear to leak into the middle ear.

**pinna:** external, visible portion of the ear. Its primary function is to carry sounds to the middle ear. Also called the auricle.

**round window:** membrane-covered opening between the inner ear and the middle ear.

**saccule:** sac-like inner ear organ containing otoliths; senses vertical motion of the head.
**sensorineural hearing loss:** hearing loss produced by abnormalities of the cochlea or the auditory nerve or of the nerve pathways that lead beyond the cochlea to the brain.

**temporal bone:** part of the skull in which the inner ear is located.

**tinnitus:** noise or ringing in the ears.

**tympanic membrane:** eardrum; separates the external ear canal from the middle-ear air cavity.

**utricle:** sac-like inner ear organ containing otoliths; senses forward, backward, and side-to-side motion of the head.

**vertigo:** perception of movement (either of the self or surrounding objects) that is not occurring or is occurring differently from how it is perceived.

**vestibulo-cochlear nerve:** nerve that carries information from the inner ear to the brain. Also called the eighth cranial nerve, auditory nerve, or acoustic nerve.

VEDA’s publications are protected under copyright. For more information, see our permissions guide at vestibular.org.

*This document is not intended as a substitute for professional health care.*
Did this free publication from VEDA help you?

Thanks to VEDA, vestibular disorders are becoming widely recognized, rapidly diagnosed, and effectively treated.

VEDA’s mission is to inform, support, and advocate for the vestibular community.

You can help! Your tax-deductible gift makes sure that VEDA’s valuable resources reach the people who can benefit from them most – vestibular patients like you!

JOIN VEDA TO DEFEAT DIZZINESS™

By making a donation of: □ $40 □ $75 □ $100 □ $250 □ $1,000 □ $2,500

Senior discounts are available; contact us for details.

Members receive a Patient Toolkit, a subscription to VEDA’s newsletter, On the Level - containing information on diagnosis, treatment, research, and coping strategies - access to VEDA’s online member forum, the opportunity to join V-PALS, a pen-pals network for vestibular patients, and more!

For healthcare professionals: Individual and clinic/hospital memberships are available. Professional members receive a subscription to VEDA’s newsletter, a listing in VEDA’s provider directory, co-branded educational publications for their patients, access to a multi-specialty online forum, and the opportunity to publish articles on VEDA’s website. For details, call (800) 837-8428, email info@vestibular.org or visit https://vestibular.org/membership.

MAILING INFORMATION

Name ____________________________________________________________________________
Address __________________________________________City _____________________________
State/Province ________________ Zip/Postal code _____________Country ____________________
Telephone __________________________E-mail _________________________________________
☐ Send my newsletter by email (Free) ☐ Send my newsletter by mail (U.S. – Free; $25 outside the U.S.)

PAYMENT INFORMATION

☐ Check or money order in U.S. funds, payable to VEDA (enclosed)
☐ Visa _____________________________________ ☐ MC Card number Exp. date (mo./yr.) CSV Code
☐ Amex ______________________________________________________________________

Billing address of card (if different from mailing information)

Or visit us on our website at https://vestibular.org to make a secure online contribution.