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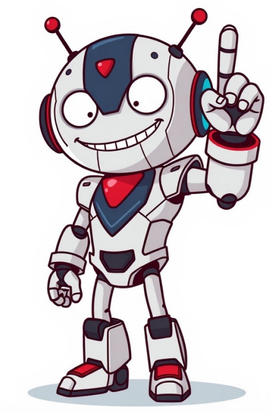

The ear is a complex sensory organ responsible for detecting sound and maintaining balance. Found in humans and many other vertebrates, the ear includes structures both visible externally and hidden deep within the skull. These structures collect sound, convert it into electrical signals, and help regulate spatial orientation. Although most commonly associated with hearing, the ear also contains the vestibular system, which helps organisms remain upright, move smoothly, and perceive body position in space.The ear detects sound and controls balance.It consists of the outer, middle, and inner ear, each with specific roles.The cochlea enables hearing by transforming vibrations into neural signals.The vestibular system within the inner ear governs balance and motion detection.Ears begin forming early in embryonic development from all three germ layers.Some animals have ear-like structures even if they lack external ears.Protecting ear health is essential for preserving communication and equilibrium.The ear is a paired organ that detects auditory stimuli and contributes to a sense of balance. In humans and many animals, it consists of an external structure for collecting sound, a mechanical system for amplifying vibrations, and an inner region for converting these vibrations into electrical impulses sent to the brain. The same organ also contains fluid-filled structures that help detect motion and maintain posture.Understanding how the ear functions begins with its anatomy. The ear is anatomically divided into three parts: the outer ear, the middle ear, and the inner ear. These sections work together in a coordinated way to perform the tasks of hearing and balance.The outer ear captures and funnels sound waves toward the middle and inner ear. It consists of:Pinna (Auricle): This is the visible flap of skin and cartilage on the side of the head. Its ridges and folds help collect sound from the environment and direct it into the ear canal. Its asymmetrical shape aids in locating the direction and height of sound sources.External Auditory Canal (Ear Canal): A slightly curved tube that leads from the pinna to the tympanic membrane. It amplifies certain sound frequencies naturally due to its shape and length.Ceruminous Glands: Specialized sweat glands in the ear canal that secrete cerumen (earwax). Earwax protects the ear by trapping dust, debris, and microorganisms. It also maintains appropriate moisture and pH, providing mild antibacterial properties.The outer ear ends at the tympanic membrane, or eardrum, which vibrates in response to sound waves.The middle ear is an air-filled cavity located within the temporal bone, between the outer and inner ear. It contains:Tympanic Membrane (Eardrum): A thin, cone-shaped membrane that vibrates in response to sound waves. It marks the boundary between the outer and middle ear.Auditory Ossicles: The three smallest bones in the human body:Malleus (hammer): Attached to the eardrum.Incus (anvil): Connects malleus and stapes.Stapes (stirrup): Transmits vibrations to the oval window of the inner ear.These bones amplify sound vibrations and transmit them efficiently to the cochlea.Eustachian Tube: A narrow passage connecting the middle ear to the nasopharynx (upper throat). It equalizes air pressure on both sides of the eardrum, especially during altitude changes like flying or diving.The inner ear is a fluid-filled, intricate system of bony and membranous labyrinths, responsible for both hearing and balance:Cochlea: A spiral-shaped organ that converts mechanical sound waves into electrical signals via hair cells in the organ of Corti. These signals are transmitted to the brain via the cochlear nerve.Vestibule: The central part of the inner ear. It contains two sacs—the utricle and saccule—which detect linear motion and gravitational pull.Semicircular Canals: Three looped tubes oriented in different planes. They detect rotational motion. The fluid inside shifts when the head moves, stimulating sensory hair cells.Vestibulocochlear Nerve (Cranial Nerve VIII): Carries information from both the cochlea (hearing) and the vestibular system (balance) to the brainstem.The inner ear is housed deep within the petrous part of the temporal bone, one of the densest bones in the body.The ear plays two major roles in the human body and in many other vertebrates: enabling hearing and maintaining balance. Each of these functions relies on different parts of the ear and on its integration with the brain.Hearing allows organisms to detect sound waves in the environment. These waves may carry information about danger, communication, prey, or surroundings. In humans, hearing enables spoken language and social interaction.The inner ear's vestibular system provides feedback on body position and head motion. It helps us walk upright, track moving objects with our eyes, and remain steady when changing posture or direction.The hearing process is a finely tuned conversion of air pressure waves into electrical signals:Sound Collection: The pinna gathers sound and directs it into the auditory canal.Eardrum Vibration: The sound waves cause the tympanic membrane to vibrate.Ossicle Amplification: Vibrations are transferred and amplified by the ossicles, culminating at the stapes pressing on the oval window.Fluid Movement: This motion generates waves in the perilymph fluid within the cochlea.Hair Cell Stimulation: The basilar membrane vibrates at specific locations depending on the sound frequency, stimulating corresponding hair cells.Signal Transmission: The hair cells convert mechanical energy into neural signals, which are sent through the cochlear nerve to the auditory cortex of the brain for interpretation.While the ear captures and converts sound waves, the brain is where hearing truly happens. The auditory pathway carries signals from the cochlea to the brain's auditory cortex, where they are processed into recognizable sounds like voices, music, and environmental noise.Cochlea: Converts mechanical vibrations into electrical impulses.Cochlear nerve fibers: Carry signals to the cochlear nuclei in the brainstem.Brainstem relays: Signals pass through the superior olivary complex (sound localization) and inferior colliculus (auditory reflexes).Thalamus (medial geniculate body): Sorts and routes auditory signals.Auditory Cortex: Located in the superior temporal gyrus, it interprets pitch, loudness, and meaning.This complex route allows for fine discrimination of sounds, speech recognition, and even emotional response to auditory stimuli.Humans detect not only sound but also its origin and direction—thanks to binaural hearing, the use of two ears spaced apart on the head. This lets the brain compare sound input from each ear and localize it.Interaural time difference (ITD): A sound reaches the closer ear slightly earlier.Interaural intensity difference (IID): A sound is louder in the nearer ear due to shadowing by the head.Pinna shape: Helps detect whether a sound comes from above, below, or behind.Locating moving objects (e.g., cars, people, animals)Navigating spaces in low visibilityEnhancing spatial awareness and safetySuperior olivary complex: First site where signals from both ears are compared.Inferior colliculus: Integrates auditory space mapping.Auditory cortex: Interprets spatial cues and allows us to "picture" our sound environment.Impairment in one ear (due to wax, infection, or hearing loss) limits sound localization, increasing risks in daily life.The vestibular portion of the inner ear constantly monitors head position and movement. The semicircular canals detect angular movement (e.g., turning the head), while the utricle and saccule detect linear motion and gravity.These structures use tiny calcium carbonate crystals (otoconia) and fluid shifts to stimulate hair cells embedded in a gelatinous membrane. The brain integrates this data with input from the eyes and skeletal muscles to maintain balance, posture, and stable vision during movement.The ear works closely with several systems:Nervous System: Coordinates sensory signals for hearing and balance with cognitive and motor responses.Musculoskeletal System: Uses balance information to adjust body position and maintain coordination.Respiratory System: The Eustachian tube connects to the upper respiratory tract, linking ear pressure regulation to breathing and swallowing.Circulatory System: Supplies oxygen and nutrients to sensitive hair cells and neurons, critical for maintaining function.Ear development begins during the third to fourth week of embryogenesis and involves all three germ layers:Ectoderm forms the otic placode, which invaginates to become the otic vesicle, eventually forming the cochlea and vestibular system.Endoderm from the first pharyngeal pouch contributes to the formation of the middle ear cavity and Eustachian tube.Mesoderm contributes to ossicle and auricle formation.By the 8th week, major structures are recognizable. Hearing begins developing around the 20th week, and the inner ear is mostly mature at birth, although auditory processing continues to develop in infancy.Ears, or structures that detect sound and balance, are found in many organisms across the animal kingdom—but their form and function vary widely. While humans and most mammals have easily recognizable external ears, many other species detect sound through internal or entirely different mechanisms. Some animals hear without traditional ear structures, and others sense vibrations through alternate means.Most—but not all—vertebrates possess specialized ear structures, although these may not resemble the external ears seen in mammals. Vertebrate ears share a common embryological origin and are typically located in the head, where they detect sound, body motion, or both. Unlike invertebrates, vertebrate ears usually contain fluid-filled chambers and hair cells that respond to mechanical stimulation.Even animals like fish, which lack external ears, have inner ear structures that detect vibration and balance. Some jawless vertebrates (e.g., lampreys) have primitive versions of the inner ear but may lack semicircular canals. However, virtually all vertebrates above this level—including amphibians, reptiles, birds, and mammals—have some form of auditory and vestibular system, although the details differ by class.In some animals, ears do more than hear—they also detect the direction and location of stimuli in ways that resemble the spatial awareness we associate with vision. While they don't detect light, these ear structures provide 3D spatial information, much like eyes do with visual fields. For example, barn owls have asymmetrical ear placement—one ear is higher than the other. This lets them detect not only horizontal but also vertical position of sounds, creating an auditory map of their environment, similar to depth perception in vision.The differences between ears reflect each group's environmental needs and evolutionary path, from sound-conducting adaptations in air to pressure-sensitive systems in water.Mammals: Have external ears, three ossicles, and a coiled cochlea. While the primary functions of the ear are hearing and balance, mammalian ears also aid in thermoregulation. Large, thin ears with dense blood vessel networks—like those in elephants or jackrabbits—release body heat into the environment.Birds: Lack pinnae but have functional inner ears with a single ossicle (columella).Reptiles and Amphibians: Use internal ears and a columella; some amphibians sense low-frequency vibrations through their skin.Fish: Lack ears but have inner ear structures and a lateral line to detect water movement and vibrations.Insects and some invertebrates have evolved auditory mechanisms:Tympanal organs in crickets and moths.Subgenual organs in ants and grasshoppers.Sensory hairs in spiders detect sound-borne vibrations.These structures often serve similar functions but evolved independently—a phenomenon known as convergent evolution.The ear is prone to a variety of medical conditions, ranging from minor infections to chronic diseases and nerve-related damage. Common conditions include:Otitis media: Infection or inflammation of the middle ear.Otitis externa: Outer ear infection, often due to moisture (swimmer's ear).Tinnitus: Perception of sound without external stimulus.Conductive hearing loss: Caused by blockage or mechanical failure.Sensorineural hearing loss: Resulting from damage to the inner ear or auditory nerve.Meniere's disease: Disorder involving vertigo, hearing loss, and tinnitus.Cholesteatoma: Abnormal skin growth in the middle ear.Barotrauma: Pressure-induced damage during altitude changes or diving.Symptoms vary depending on the specific condition but may include:Ear pain or discomfortHearing loss (sudden or gradual)Ringing or buzzing noisesDizziness or vertigoEar fullness or pressureFluid drainage or pusImbalance or unsteadinessNausea or vomiting (from vestibular dysfunction)Presbycusis is the gradual loss of hearing that occurs as people age. It is one of the most common chronic conditions affecting older adults and can significantly impact communication, safety, and quality of life.Loss of hair cells in the cochleaStiffening of the basilar membraneReduced blood supply to inner ear structuresDegeneration of the auditory nerveTypically affects high-frequency sounds firstSounds may seem muffled or distantDifficulty understanding speech, especially in noisy environmentsOften affects both ears symmetricallyUse ear protection around loud noises.Manage cardiovascular health, which affects inner ear blood flow.Hearing aids and cochlear implants can restore function.Auditory training and speech-reading improve communication.Early screening and treatment are key to minimizing impact.A variety of diagnostic tools evaluate ear function and identify disorders:Otoscopy: Visual inspection using a lighted device to examine the ear canal and eardrum.Audiometry: Measures hearing sensitivity and frequency range.Tympanometry: Assesses eardrum mobility and middle ear pressure.Otoacoustic Emissions (OAE): Measures sounds generated by the inner ear, useful for newborn screening.Vestibular testing (ENG/VNG): Analyzes eye movement and inner ear balance response.CT or MRI scans: Reveal tumors, bone abnormalities, or fluid buildup.Maintaining healthy ears is important for hearing and balance:Avoid inserting objects: Don't use cotton swabs or sharp objects in the ear canal.Dry ears after swimming: Use a towel or tilt your head to remove excess water.Limit exposure to loud noise: Use ear protection in noisy environments.Manage allergies and infections: Treat colds, sinus issues, and allergies promptly to reduce risk of ear infections.Practice good hygiene: Clean outer ears gently and monitor for wax buildup.Seek medical attention: If you notice pain, sudden hearing loss, or persistent ringing.Many people experience ear discomfort or pain during airplane takeoff, landing, or while scuba diving. This happens because of rapid changes in air pressure, which affect the middle ear.The middle ear is a sealed chamber.Pressure differences cause the eardrum to stretch inward or outward, leading to pain or muffled hearing.The Eustachian tube equalizes this pressure by opening when we swallow or yawn.Ear fullnessMuffled hearingSharp or dull painTemporary dizzinessSwallowing, yawning, or chewing gumPerform the Valsalva maneuver: pinch your nose, close your mouth, and gently blowUse filtered earplugs (e.g., for flying)Decongestants or nasal sprays before travel, especially when congestedAvoid diving or flying with a cold or sinus infectionIf symptoms persist after travel or worsen, consult a doctor—barotrauma or fluid buildup may require treatment.Acoustic neuroma – A benign tumor on the vestibulocochlear nerve that can affect hearing and balance.Audiometry – A hearing test that measures a person's ability to hear various sound frequencies and intensities.Auricle (Pinna) – The visible part of the outer ear that collects sound waves and directs them into the ear canal.Barotrauma – Injury caused by pressure changes, often occurring during flying, diving, or altitude shifts.Cochlea – A spiral-shaped, fluid-filled structure in the inner ear that converts sound vibrations into electrical signals.Conductive hearing loss – Hearing loss caused by obstruction or damage in the outer or middle ear that prevents sound transmission.Cerumen – Commonly known as earwax; a protective substance secreted in the ear canal to trap debris and microbes.Eardrum (Tympanic membrane) – A thin membrane that vibrates in response to sound waves, separating the outer ear from the middle ear.Electronystagmography (ENG) – A diagnostic test that records involuntary eye movements to assess balance function.Eustachian tube – A canal connecting the middle ear to the upper throat that equalizes air pressure on both sides of the eardrum.Hair cells – Specialized sensory cells in the cochlea and vestibular system that detect mechanical vibrations or fluid movement.Inner ear – The innermost part of the ear containing the cochlea and vestibular system, essential for hearing and balance.Labyrinth – The complex system of fluid-filled tubes and chambers in the inner ear.Lateral line – A sensory system in fish and some amphibians that detects vibrations and movement in water, functioning similarly to hearing.Malleus (Hammer) – The first of the three auditory ossicles in the middle ear, attached to the eardrum.Meniere's disease – A disorder of the inner ear causing vertigo, tinnitus, hearing loss, and pressure sensation.Middle ear – The air-filled chamber between the eardrum and the inner ear that contains the auditory ossicles.Otitis externa – An infection or inflammation of the external ear canal, often called swimmer's ear.Otitis media – Infection or inflammation of the middle ear, common in children.Otoacoustic emissions (OAE) – Sounds emitted by the cochlea in response to stimuli, used to assess inner ear function.Otoliths – Small calcium carbonate crystals in the vestibular system that help detect gravity and linear acceleration.Outer ear – The part of the ear including the pinna and auditory canal that collects sound and channels it to the eardrum.Pinna (Auricle) – See "Auricle."Sensorineural hearing loss – Hearing loss resulting from damage to the cochlea or auditory nerve.Semicircular canals – Three looped structures in the inner ear that detect rotational movement of the head.Stapes (Stirrup) – The smallest bone in the human body and the third ossicle, which transmits sound to the inner ear through the oval window.Tinnitus – A perception of ringing, buzzing, or other sound in the ears without an external source.Tympanometry – A test that measures the mobility of the eardrum and middle ear pressure.Tympanic membrane – See "Eardrum."Utricle and Saccule – Vestibular organs that detect linear movement and gravitational orientation.Vestibular system – A sensory system in the inner ear that provides the brain with information about motion, head position, and spatial orientation.Vestibulocochlear nerve (Cranial Nerve VIII) – The nerve that transmits hearing and balance signals from the inner ear to the brain.A: When air pressure around you changes rapidly—such as during takeoff, landing, or elevation shifts—the pressure inside your middle ear becomes unequal with the environment. Your Eustachian tubes usually open to equalize this pressure. Yawning, swallowing, or chewing gum can help open them and "pop" your ears.A: Tinnitus is the perception of ringing, buzzing, or humming sounds in the absence of an external source. It can result from noise exposure, earwax buildup, age-related hearing loss, inner ear damage, or medications. Sometimes, the exact cause is unknown.A: Earwax (cerumen) is actually beneficial—it traps dust, debris, and microbes while keeping the ear canal moist and protected. Most of the time, earwax moves outward naturally. You should avoid inserting objects (like cotton swabs) into your ear. Only remove wax from the outer ear or see a healthcare provider if you suspect buildup.A: The vestibular system in your inner ear controls balance. Spinning causes fluid in the semicircular canals to keep moving even after you stop, making you feel dizzy. Inner ear infections can inflame or damage these balance sensors, causing vertigo, nausea, and unsteadiness.A: Yes. Repeated or prolonged exposure to sounds above 85 decibels (dB)—like concerts, headphones at high volume, or power tools—can damage hair cells in the cochlea. Once lost, these cells don't regenerate, leading to permanent hearing loss. Ear protection and volume control are important.A: Yes—ears do grow gradually over time, primarily due to ongoing cartilage growth and changes in collagen and skin elasticity. Although gravity and tissue sagging contribute, studies have shown that ear length—especially earlobe length—increases with age. This slow growth even helps forensic scientists estimate age.A: This is a common experience called age-related high-frequency hearing loss, or presbycusis. Over time, exposure to sound and natural aging cause damage to the hair cells in the cochlea, particularly those responsible for detecting higher frequencies (often above 14–16 kHz). Children and teens may hear pitches that adults cannot, which is why some "teen buzz" ringtones are inaudible to older listeners.A:Sensorineural hearing loss involves damage to the inner ear or auditory nerve and is often permanent.Conductive hearing loss is caused by blockages or mechanical issues in the outer or middle ear, such as wax buildup or a ruptured eardrum, and is often treatable.A: You should seek medical attention if you experience:Sudden hearing lossPersistent or severe ear painOngoing ringing or buzzingFluid draining from the earDizziness, nausea, or balance problemsPrompt care helps prevent complications and permanent damage.

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Related Posts Your ear's anatomy includes the outer part (pinna) that captures sound, guiding it through the ear canal to your eardrum (tympanic membrane), which vibrates in response to sound waves. These vibrations transfer to tiny bones (ossicles) in the middle ear that amplify and transmit the signals to your inner ear. Understanding how each part works together helps you appreciate your hearing process even more—if you look closer, you'll discover how each component contributes to this intricate system. Key Takeaways The outer ear includes the pinna and ear canal, which collect and direct sound toward the eardrum. The ear canal maintains a protective, slightly acidic environment and amplifies certain sound frequencies. The tympanic membrane (eardrum) vibrates in response to sound waves, converting them into mechanical signals. The middle ear contains ossicles (malleus, incus, stapes) that amplify vibrations for the inner ear. Visual guides highlight ear structures' roles in sound collection, transmission, and overall auditory function. The ear is a complex organ responsible for hearing and balance, and understanding its anatomy helps you appreciate how these essential functions work together. When you look into the structure of your ear, you'll notice the outer part, known as the pinna, which helps capture sound waves and direct them inward. These sound waves enter your ear canal, a tube that extends inward toward the middle ear. The ear canal isn't just a passive passage; it protects the delicate inner parts of your ear and maintains a slightly acidic environment to prevent infections. The shape and length of the ear canal influence how you perceive different frequencies and contribute to your sense of sound localization. At the end of the ear canal lies the tympanic membrane, commonly called the eardrum. When sound waves reach this membrane, they cause it to vibrate. These vibrations are critical because they serve as the first step in transforming airborne sound into signals your brain can interpret. The tympanic membrane acts as a barrier that separates the outer ear from the middle ear, and its vibrations are transferred to three tiny bones—the ossicles—in the middle ear. These bones are the malleus, incus, and stapes, and they amplify the vibrations, making it easier for your inner ear to detect them. Understanding the role of the ear canal and tympanic membrane helps you see how sound is initially collected and processed. The ear canal's shape and length influence how you perceive different frequencies, giving you a sense of direction and distance of sounds. Meanwhile, the tympanic membrane's ability to vibrate efficiently depends on the sound's intensity and frequency, which directly impacts your hearing clarity. Any damage or infection affecting the ear canal or tympanic membrane can cause hearing loss or discomfort, highlighting their significance in your auditory health. Additionally, the health of the tympanic membrane and ear canal can be affected by various conditions, emphasizing the importance of maintaining ear hygiene and protection. Moreover, the tympanic membrane isn't just a passive barrier—it's a living tissue that can heal if injured, and its health is essential for proper hearing. The ear canal also plays a role in protecting your middle and inner ear from debris, insects, and water. You might notice that your ear canal produces wax, which traps dirt and reduces the risk of infections. This wax acts as a natural barrier, reinforcing the protective function of the ear canal and helping maintain overall ear health. In short, the ear canal and tympanic membrane form the gateway for sound entry and initial processing. Their structure and function are fundamental for converting sound waves into the mechanical vibrations that your brain ultimately interprets as hearing. By understanding these parts, you gain a better appreciation of how your ear works to keep you connected to the world of sound. Recognizing the importance of ear health can help you take steps to protect this vital organ. Frequently Asked Questions How Does the Ear Convert Sound Waves Into Electrical Signals? When sound waves reach your ear, they travel through the ear canal and vibrate the eardrum. These vibrations move to the inner ear, where tiny hair cells convert them into electrical signals. The auditory nerve then carries these signals to your brain, allowing you to perceive sound. Your inner ear acts as the key converter, turning mechanical vibrations into the electrical signals that your brain interprets as hearing. What Causes Common Ear Infections and How Are They Treated? Ear infection causes often include bacteria, viruses, or fungi entering through the ear canal, leading to inflammation. You might experience pain, swelling, or fluid buildup. For ear infection treatment, doctors typically recommend antibiotics for bacterial infections, pain relievers, or warm compresses. It is crucial to keep your ears dry and avoid inserting objects. Prompt treatment helps prevent complications and relieves discomfort, so see a healthcare professional if symptoms persist. How Does the Ear Maintain Balance and Spatial Orientation? Balance begins with your brain, but your ear's vestibular system plays a starring role. It senses changes in head position and motion, activating equilibrium mechanisms that keep you steady. When you tilt or turn, tiny hair cells in the semicircular canals detect movement, sending signals to your brain. This seamless system helps you stay balanced and oriented, whether you're walking, spinning, or stopping suddenly. Can Ear Anatomy Vary Significantly Between Individuals? You might notice that ear size and ear shape vary widely among individuals. These differences are normal and result from genetic factors, developmental processes, and ethnicity. While the overall structure of the ear remains consistent, subtle variations in size and shape can influence how your ears look and sometimes affect hearing or balance. So, yes, ear anatomy can differ markedly from person to person, making each set of ears unique. What Are the Latest Advancements in Hearing Aid Technology? You'll find that the latest advancements in hearing aid technology include innovative hearing devices that use sophisticated digital signal processing. These devices enhance sound quality, reduce background noise, and adapt automatically to your environment. With features like wireless connectivity and rechargeable batteries, these advancements make hearing aids more comfortable and convenient, improving your overall hearing experience markedly. Staying updated ensures you benefit from the most effective and user-friendly solutions available today. Conclusion Now that you've explored the intricate anatomy of your ear, think of it as your personal lighthouse, guiding sound safely to your mind. Just like the ancient mariners relied on their lighthouses, your ear's delicate structures guarantee you catch every whisper and melody. Respect this marvel of nature, for it's your gateway to the world of sound. Keep it healthy, and let your ear be a steadfast beacon, illuminating life's symphony around you. This helpful article and diagram explain how all the parts of the ear work together. FacebookXLinkedinEmailCopy LinkPrint The ear is a complex and delicate organ. It collects sound waves so you can hear the world around you. The ear also has a second function—it helps you keep your balance. Your ear can be divided into 3 main parts. These are the outer ear, the middle ear, and the inner ear. The outer ear and middle ear help collect and amplify sound. The inner ear converts sound waves to messages that are sent to the brain. The inner ear also senses the movement and position of your head and body. It helps you maintain your balance and see clearly, even when you change positions. Here's how the different parts of your ear work together to help you hear and stay balanced: Mastoid bone. This surrounds the middle ear. External ear. This collects sound waves. Ear canal. This carries those sound waves to the eardrum. Eardrum. This vibrates from the sound waves, setting the middle ear bones in motion. Middle ear bones (ossicles). These vibrate, sending the sound waves to the inner ear. When the ear is healthy, air pressure stays balanced in the middle ear. Eustachian tube. This helps control air pressure in the middle ear. Semicircular canals. These help maintain balance. Vestibular nerve. This carries balance signals to the brain. Cochlea. This picks up the sound waves and makes nerve signals. Auditory nerve. This carries the sound signals to the brain. There are many diseases and conditions that can affect your ears, including infection, eustachian tube dysfunction, swimmer's ear and more.Ear infection (otitis media)Ear infections most commonly occur in your middle ear. Otitis media develops when bacteria and viruses become trapped in your middle ear. This type of infection is more likely to affect children than adults. Ear infection treatment usually involves antibiotics. In severe cases, ear tubes may be necessary.Eustachian tube dysfunctionYour eustachian tubes connect your middle ears to your throat. When you yawn, sneeze or swallow, your eustachian tubes open to equalize the pressure inside of your ears. If these tubes become clogged, it's called eustachian tube dysfunction. Symptoms include tinnitus, muffled hearing, sensation of fullness and possible ear pain.Swimmer's ear (otitis externa)Swimmer's ear is an ear canal infection caused by bacteria or fungi. Getting water in your ear can cause this condition. Swimmer's ear can also occur if you get hair spray or other irritants inside of your ear canal. Additionally, it's common for people to injure their ear canal with cotton swabs. (Note: When ear cleaning, you should never place cotton swabs inside of your ear canal.)Ruptured eardrumIf you get a hole in your tympanic membrane, it's called a ruptured eardrum. (Your eardrum separates your outer ear from your middle ear.) Infection, trauma, loud sounds or foreign objects in your ears can cause a ruptured eardrum. In most cases, a ruptured eardrum will heal on its own in a few weeks. But sometimes, it requires surgical repair, such as tympanoplasty.OtosclerosisOtosclerosis is when abnormal bone remodeling occurs in your middle ear. Bone remodeling is a normal lifelong process in which existing bone tissue replaces itself with new bone tissue. When this process doesn't go as expected, however, it can cause health problems. With otosclerosis, the tiny bones inside of your middle ear (the malleus, incus and stapes) become hardened and stop vibrating. As a result, sound doesn't travel properly. Surgery is usually necessary to treat otosclerosis.PerichondritisPerichondritis occurs when the skin of your outer ear becomes infected. This condition is usually the result of injury or trauma, such as piercings, contact sports or ear surgery. Antibiotics are necessary to treat perichondritis. In rare cases, you may need surgery to drain any pus from the area.Vestibular neuritisVestibular neuritis occurs when the vestibular nerve in your inner ear becomes inflamed. People with this condition experience a sudden vertigo attack, which is often accompanied by nausea and vomiting. Your healthcare provider will treat vestibular neuritis with medication and possible physical therapy.Meniere's diseaseThis chronic condition affects your inner ear. Common symptoms include dizziness, vertigo and a feeling of fullness in the ear. Most of the time, Meniere's disease improves on its own over time. However, in severe cases, surgery might be necessary.Ear injuryCuts, fractures and blunt force trauma can cause ear injury. If damage is severe, surgery may be necessary to address the problem. This may include surgery to preserve hearing or cosmetic surgery to improve the appearance of your ear.Ear tumorsEar tumors may be benign (noncancerous) or malignant (cancerous). Types of noncancerous ear tumors include keloids, sebaceous cysts, osteomas and exostoses (bone growths). Noncancerous ear tumors usually require surgical removal.Cancers that can affect your ears include melanoma, basal cell carcinoma and squamous cell carcinoma. Treatment for these conditions depends on several factors, including the type and stage of cancer, and whether or not it has spread to other parts of your body.What are some symptoms of common ear conditions?There are a number of symptoms that could indicate a problem with your ears. These warning signs include:Ear pain.Ear infection.Clogged ears.Muffled hearing.Itchy ears.Nausea and vomiting.A feeling of fullness in your ears.Ear drainage.What tests will my healthcare provider use to check my ears?Your healthcare provider can perform a wide range of tests to check your ears. Common hearing tests include:Pure-tone testing. This simple hearing test involves wearing headphones and raising your hand when you hear a "beep." Pure-tone testing tells your healthcare provider the quietest sound you can hear at different frequencies.Middle ear tests. These tests can determine how well your eardrum functions. They can also tell your healthcare provider if you have a ruptured eardrum.Speech testing. Sometimes, your provider may give you a speech test to determine how well you hear and repeat words.Auditory brainstem response (ABR). During this test, your provider places electrodes on your head. These electrodes record your brain activity. The goal is to see how your brain responds to sounds played through headphones. The ABR is often performed on people who can't complete a typical hearing screening.Otoacoustic emissions (OAEs). This test determines how well your cochlea works. When sound reaches your inner ear, the tiny hairs inside of your cochlea vibrate. This vibration produces a very soft sound that echoes back into your middle ear (an otoacoustic emission, or OAE). If you have significant hearing loss, your inner ear won't produce OAEs at all. Organ of hearing and balance For other uses, see Ear (disambiguation). EarThe outer portion of the human ear"Ear" pronounced (Received Pronunciation)DetailsSystemAuditory systemIdentifiersLatinaurisMeSHD004423NeuroLex IDbirnlex_1062TA98A01.1.00.005 A15.3.00.001TA26861FMA52780Anatomical terminology[edit on Wikidata] This article is one of a series documenting the anatomy of theHuman ear Outer ear Auricle Ear canal Middle ear Tympanic membrane Ossicles Malleus Incus Stapes Inner ear Vestibules Utricle Saccule Cochlea Semicircular canals vte How sounds make their way from the source to the human brain In vertebrates, an ear is the organ that enables hearing and (in mammals) body balance using the vestibular system. In humans, the ear is described as having three parts: the outer ear, the middle ear and the inner ear. The outer ear consists of the auricle and the ear canal. Since the outer ear is the only visible portion of the ear, the word "ear" often refers to the external part (auricle) alone.[1] The middle ear includes the tympanic cavity and the three ossicles. The inner ear sits in the bony labyrinth, and contains structures which are key to several senses: the semicircular canals, which enable balance and eye tracking when moving; the utricle and saccule, which enable balance when stationary; and the cochlea, which enables hearing. The ear canal is cleaned via earwax, which naturally migrates to the auricle. The ear develops from the first pharyngeal pouch and six small swellings that develop in the early embryo called otic placodes, which are derived from the ectoderm. The ear may be affected by disease, including infection and traumatic damage. Diseases of the ear may lead to hearing loss, tinnitus and balance disorders such as vertigo, although many of these conditions may also be affected by damage to the brain or neural pathways leading from the ear. The human ear has been adorned by earrings and other jewelry in numerous cultures for thousands of years, and has been subjected to surgical and cosmetic alterations. The human ear consists of three parts—the outer ear, middle ear and inner ear.[2] The ear canal of the outer ear is separated from the air-filled tympanic cavity of the middle ear by the eardrum. The middle ear contains the three small bones—the ossicles—involved in the transmission of sound, and is connected to the throat at the nasopharynx, via the pharyngeal opening of the Eustachian tube. The inner ear contains the otolith organs—the utricle and saccule—and the semicircular canals belonging to the vestibular system, as well as the cochlea of the auditory system.[2] Main article: Outer ear The outer ear is the external portion of the ear and includes the fleshy visible auricle, the ear canal, and the outer layer of the eardrum (also called the tympanic membrane).[2][3] The auricle consists of the curving outer rim called the helix, the inner curved rim called the antihelix, and opens into the ear canal. The tragus protrudes and partially obscures the ear canal, as does the facing antitragus. The hollow region in front of the ear canal is called the concha. The ear canal stretches for about 1 inch (2.5 cm). The first part of the canal is surrounded by cartilage, while the second part near the eardrum is surrounded by bone. This bony part is known as the auditory bulla and is formed by the tympanic part of the temporal bone. The ear canal ends at the external surface of the eardrum, while the surrounding skin contains ceruminous and sebaceous glands that produce protective earwax.[3] Earwax naturally migrates outward through ear canal, constituting a self-cleaning system.[4][5][6][7] Two sets of muscles are associated with the outer ear: the intrinsic and extrinsic muscles. In some mammals, these muscles can adjust the direction of the pinna.[3] In humans, these muscles have little or no effect.[8] The ear muscles are supplied by the facial nerve, which also supplies sensation to the skin of the ear itself, as well as to the external ear cavity. The great auricular nerve, auricular nerve, auriculotemporal nerve, and lesser and greater occipital nerves of the cervical plexus all supply sensation to parts of the outer ear and the surrounding skin.[3] The auricle consists of a single piece of elastic cartilage with a complicated relief on its inner surface and a fairly smooth configuration on its posterior surface. A tubercle, known as Darwin's tubercle, is sometimes present, lying in the descending part of the helix and corresponding to the ear-tip of mammals. The earlobe consists of areola and adipose tissue.[9] The symmetrical arrangement of the two ears allows for the localisation of sound. The brain accomplishes this by comparing arrival-times and intensities from each ear, in circuits located in the superior olivary complex and the trapezoid bodies, which are connected via pathways to both ears.[10] Main article: Middle ear The middle ear The middle ear lies between the outer ear and the inner ear. It consists of an air-filled cavity called the tympanic cavity and includes the three ossicles and their attaching ligaments; the auditory tube; and the round and oval windows. The ossicles are three small bones that function together to receive, amplify, and transmit the sound from the eardrum to the inner ear. The ossicles are the malleus (hammer), incus (anvil), and the stapes (stirrup). The stapes is the smallest named bone in the body. The middle ear also connects to the upper throat at the nasopharynx via the pharyngeal opening of the Eustachian tube.[3][11] The three ossicles transmit sound from the outer ear to the inner ear. The malleus receives vibrations from sound pressure on the eardrum, where it is connected at its longest part (the manubrium or handle) by a ligament. It transmits vibrations to the incus, which in turn transmits the vibrations to the small stapes bone. The wide base of the stapes rests on the oval window. As the stapes vibrates, vibrations are transmitted through the oval window, causing movement of fluid within the cochlea.[3] The round window allows for the fluid within the inner ear to move. As the stapes pushes the secondary tympanic membrane, fluid in the inner ear moves and pushes the membrane of the round window out by a corresponding amount into the middle ear. The ossicles help amplify sound waves by nearly 15–20 times.[2] The outer ear receives sound, transmitted through the ossicles of the middle ear to the inner ear, where it is converted to a nervous signal in the cochlear and transmitted along the vestibulocochlear nerve.Main article: Inner ear The inner ear sits within the temporal bone in a complex cavity called the bony labyrinth. A central area known as the vestibule contains two small fluid-filled recesses, called the utricle and saccule. These connect to the semicircular canals and the cochlea. There are three semicircular canals angled at right angles to each other which are responsible for dynamic balance. The cochlea is a spiral shell-shaped organ responsible for the sense of hearing. These structures together create the membranous labyrinth.[12] The bony labyrinth refers to the bony compartment which contains the membranous labyrinth, contained within the temporal bone. The inner ear structurally begins at the oval window, which receives vibrations from the incus of the middle ear. Vibrations are transmitted into the inner ear into a fluid called endolymph, which fills the membranous labyrinth. The endolymph is situated in two vestibules, the utricle and saccule, and eventually transmits to the cochlea, a spiral-shaped structure. The cochlea consists of three fluid-filled spaces: the vestibular duct, the cochlear duct, and the tympanic duct.[3] Hair cells responsible for transduction—changing mechanical changes into electrical stimuli are present in the organ of Corti in the cochlea.[12] The blood supply of the ear differs according to each part of the ear. The outer ear is supplied by a number of arteries. The posterior auricular artery provides the majority of the blood supply. The anterior auricular arteries provide some supply to the outer rim of the ear and scalp behind it. The posterior auricular artery is a direct branch of the external carotid artery, and the anterior auricular arteries are branches from the superficial temporal artery. The occipital artery also plays a role.[12] The middle ear is supplied by the mastoid branch of either the occipital or posterior auricular arteries and the deep auricular artery, a branch of the maxillary artery. Other arteries which are present but play a smaller role include branches of the middle meningeal artery, ascending pharyngeal artery, internal carotid artery, and the artery of the pterygoid canal.[12] The inner ear is supplied by the anterior tympanic branch of the maxillary artery; the stylomastoid branch of the posterior auricular artery; the petrosal branch of middle meningeal artery; and the labyrinthine artery, arising from either the anterior inferior cerebellar artery or the basilar artery.[12] Main article: Hearing Sound waves travel through the outer ear, are modulated by the middle ear, and are transmitted to the vestibulocochlear nerve in the inner ear. This nerve transmits information to the temporal lobe of the brain, where it is registered as sound. Sound that travels through the outer ear impacts on the eardrum, and causes it to vibrate. The three ossicles bones transmit this sound to a second window (the oval window), which protects the fluid-filled inner ear. In detail, the pinna of the outer ear helps to focus a sound, which impacts on the eardrum. The malleus rests on the membrane, and receives the vibration. This vibration is transmitted along the incus and stapes to the oval window. Two small muscles, the tensor tympani and stapedius, also help modulate noise. The two muscles reflexively contract to dampen excessive vibrations. Vibration of the oval window causes vibration of the endolymph within the vestibule and the cochlea.[13] The inner ear houses the apparatus necessary to change the vibrations transmitted from the outside world via the middle ear into signals passed along the vestibulocochlear nerve to the brain. The hollow channels of the inner ear are filled with liquid, and contain a sensory epithelium that is studded with hair cells. The microscopic "hairs" of these cells are structural protein filaments that project out into the fluid. The hair cells are mechanoreceptors that release a chemical neurotransmitter when stimulated. Sound waves moving through fluid flows against the receptor cells of the organ of Corti. The fluid pushes the filaments of individual cells; movement of the filaments causes receptor cells to become open to receive the potassium-rich endolymph. This causes the cell to depolarise, and creates an action potential that is transmitted along the spiral ganglion, which sends information through the auditory portion of the vestibulocochlear nerve to the temporal lobe of the brain.[13] The human ear can generally hear sounds with frequencies between 20 Hz and 20 kHz (the audio range). Sounds outside this range are considered infrasound (below 20 Hz)[14] or ultrasound (above 20 kHz)[15] Although hearing requires an intact and functioning auditory portion of the central nervous system as well as a working ear, human deafness (extreme insensitivity to sound) most commonly occurs because of abnormalities of the inner ear, rather than in the nerves or tracts of the central auditory system. Main articles: Balance (ability) and Equilibrioception Providing balance, when moving or stationary, is also a central function of the ear. The ear facilitates two types of balance: static balance, which allows a person to feel the effects of gravity, and dynamic balance, which allows a person to sense acceleration. Static balance is provided by two ventricles, the utricle and the saccule. Cells lining the walls of these ventricles contain fine filaments, and the cells are covered with a fine gelatinous layer. Each cell has 50–70 small filaments, and one large filament, the kinocilium. Within the gelatinous layer lie otoliths, tiny formations of calcium carbonate. When a person moves, these otoliths shift position. This shift alters the positions of the filaments, which opens ion channels within the cell membranes, creating depolarisation and an action potential that is transmitted to the brain along the vestibulocochlear nerve.[13][16] Dynamic balance is provided through the three semicircular canals. These three canals are orthogonal (at right angles) to each other. At the end of each canal is a slight enlargement, known as the ampulla, which contains numerous cells with filaments in a central area called the cupula. The fluid in these canals rotates according to the momentum of the head. When a person changes acceleration, the inertia of the fluid changes. This affects the pressure on the cupula, and results in the opening of ion channels. This causes depolarisation, which is passed as a signal to the brain along the vestibulocochlear nerve.[13] Dynamic balance also helps maintain eye tracking when moving, via the vestibulo-ocular reflex. During embryogenesis, the ear develops as three distinct structures: the inner ear, the middle ear and the outer ear.[17] Each structure originates from a different germ layer: the ectoderm, endoderm and mesenchyme.[18][19] The otic placode on a developing embryo (about four weeks old) The ear develops in the lower neck region and moves upwards as the mandible develops (six weeks). Around its second to third week, the developing embryo consists of three layers: ectoderm, mesoderm, and endoderm. The first part of the ear to develop is the inner ear,[19] which begins to form from the ectoderm around the embryo's 22nd day,[18] derived from two thickenings called otic placodes on either side of the head. Each otic placode recedes below the ectoderm, forms an otic pit and then an otic vesicle.[20] This entire mass is eventually surrounded by mesenchyme to form the bony labyrinth.[20][21] Around the 28th day, parts of the otic vesicle begin to form the vestibulocochlear nerve.[20][22] These form bipolar neurons, which supply sensation to parts of the inner ear (namely the sensory parts of the semicircular canals, macular of the utricle and saccule, and organ of Corti).[20] Around the 33rd day, the vesicles begin to differentiate. Posteriorly, they form what will become the utricle and semicircular canals. Anteriorly, the vesicles differentiate into a rudimentary saccule, which eventually becomes the saccule and cochlea. Part of the saccule eventually gives rise and connects to the cochlear duct, which appears approximately during the sixth week and connects to the saccule through the ductus reuniens.[18] As the cochlear duct's mesenchyme begins to differentiate, three cavities are formed: the scala vestibuli, the scala tympani and the scala media.[18][21] Both the scala vestibuli and the scala tympani contain an extracellular fluid called perilymph, while the scala media contains endolymph.[21] The vestibular membrane and the basilar membrane develop to separate the cochlear duct from the vestibular duct and the tympanic duct, respectively.[18] Molecular regulation Most of the genes responsible for the regulation of inner ear formation and its morphogenesis are members of the homeobox gene family such as Pax, Msx and Otx homeobox genes. The development of inner ear structures such as the cochlea is regulated by Dlx5/Dlx6, Otx1/Otx2 and Pax2, which in turn are controlled by the master gene Shh. Shh is secreted by the notochord.[23] The middle ear and its components develop from the first and second pharyngeal arches.[20] The tympanic cavity and auditory tube develop from the first part of the pharyngeal pouch between the first two arches in an area which will also go on to develop the pharynx. This develops as a structure called the tubotympanic recess.[20] The ossicles (malleus, incus and stapes) normally appear during the first half of fetal development. The first two (malleus and incus) derive from the first pharyngeal arch and the stapes derives from the second.[18] All three ossicles develop from the neural crest.[20] Eventually, cells from the tissue surrounding the ossicles will experience apoptosis and a new layer of endodermal epithelial will constitute the formation of the tympanic cavity wall.[18][19] Unlike structures of the inner and middle ear, which develop from pharyngeal pouches, the ear canal originates from the dorsal portion of the first pharyngeal cleft.[18][20] It is fully expanded by the end of the 18th week of development.[21] The eardrum is made up of three layers (ectoderm, endoderm and connective tissue). The auricle originates as a fusion of six hillocks. The first three hillocks are derived from the lower part of the first pharyngeal arch and form the tragus, crus of the helix, and helix, respectively. The final three hillocks are derived from the upper part of the second pharyngeal arch and form the antihelix, antitragus, and earlobe.[18][20][21] The outer ears develop in the lower neck. As the mandible forms, they move towards their final position level with the eyes.[17][22] The ears of newborn humans are proportionally very large, even more so than the head's largeness as compared to the body. Ears grow quickly until about the age of nine, then continue to grow steadily in circumference (about 0.5 millimeters a year) throughout life, with the increase in length more extreme in males.[24][25] Ears are individually almost unique, with the odds of two people having matching ears being very low.[26] Additionally, the ear's proportions are normally retained for life, and have thus been employed for forensic identification since the 1950s.[27] Main article: Hearing loss Hearing loss may be either partial or total. This may be a result of injury or damage, congenital disease, or physiological causes. When hearing loss is a result of injury or damage to the outer ear or middle ear, it is known as conductive hearing loss. When deafness is a result of injury or damage to the inner ear, vestibulochoclear nerve, or brain, it is known as sensorineural hearing loss. Perforation (otoscope)Fluid in middle ear cavityOtitis media complications can lead to hearing loss. Causes of conductive hearing loss include an ear canal blocked by earwax, ossicles that are fixed together or absent, or holes in the eardrum. Conductive hearing loss may also result from middle ear inflammation causing fluid build-up in the normally air-filled space, such as by otitis media. Tympanoplasty is the general name of the operation to repair the middle ear's eardrum and ossicles. Grafts from muscle fascia are ordinarily used to rebuild an intact eardrum. Sometimes artificial ear bones are placed to substitute for damaged ones, or a disrupted ossicular chain is rebuilt in order to conduct sound effectively. Hearing aids or cochlear implants may be used if the hearing loss is severe or prolonged. Hearing aids work by amplifying the sound of the local environment and are best suited to conductive hearing loss.[28] Cochlear implants transmit the sound that is heard as if it were a nervous signal, bypassing the cochlea. Active middle ear implants send sound vibrations to the ossicles in the middle ear, bypassing any non-functioning parts of the outer and middle ear. Anomalies and malformations of the auricle are common. These anomalies include chromosome syndromes such as ring 18. Children may also present cases of abnormal ear canals and low ear implantation.[19] In rare cases, no auricle is formed (atresia), or is extremely small (microtia). Small auricles can develop when the auricular hillocks do not develop properly. The ear canal can fail to develop if it does not channelise properly or if there is an obstruction.[19] Reconstructive surgery to treat hearing loss is considered as an option for children older than five,[29] with a cosmetic surgical procedure to reduce the size or change the shape of the ear is called an otoplasty. The initial medical intervention is aimed at assessing the baby's hearing and the condition of the ear canal, as well as the middle and inner ear. Depending on the results of tests, reconstruction of the outer ear is done in stages, with planning for any possible repairs of the rest of the ear.[30][31][32] Approximately one out of one thousand children suffer some type of congenital deafness related to the development of the inner ear.[33] Inner ear congenital anomalies are related to sensorineural hearing loss and are generally diagnosed with a computed tomography (CT) scan or a magnetic resonance imaging (MRI) scan.[29] Hearing loss problems also derive from inner ear anomalies because its development is separate from that of the middle and external ear.[19] Middle ear anomalies can occur because of errors during head and neck development. The first pharyngeal pouch syndrome associates middle ear anomalies to the malleus and incus structures as well as to the non-differentiation of the annular stapedial ligament. Temporal bone and ear canal anomalies are also related to this structure of the ear and are known to be associated with sensorineural hearing loss and conductive hearing loss.[29] Main article: Vertigo Vertigo refers to the inappropriate perception of motion. This is due to dysfunction of the vestibular system. One common type of vertigo is benign paroxysmal positional vertigo, when an otolith is displaced from the ventricles to the semicircular canal. The displaced otolith rests on the cupola, causing a sensation of movement when there is none. Ménière's disease, labyrinthitis, strokes, and other infective and congenital diseases may also result in the perception of vertigo.[34] Outer ear Injuries to the external ear occur fairly frequently, and can leave minor to major deformity. Injuries include: laceration, avulsion injuries, burn and repeated twisting or pulling of an ear, for discipline or torture.[35] Chronic damage to the ears can cause cauliflower ear, a common condition in boxers and wrestlers in which the cartilage around the ears becomes lumpy and distorted owing to persistence of a haematoma around the perichondrium, which can impair blood supply and healing.[36] Owing to its exposed position, the external ear is susceptible to frostbite[37] as well as skin cancers, including squamous-cell carcinoma and basal-cell carcinomas.[38] Middle ear The ear drum may become perforated in the event of a large sound or explosion, when diving or flying (called barotrauma), or by objects inserted into the ear. Another common cause of injury is due to an infection such as otitis media.[39] These may cause a discharge from the ear called otorrhea,[40] and are often investigated by otoscopy and audiometry. Treatment may include watchful waiting, antibiotics and possibly surgery, if the injury is prolonged or the position of the ossicles is affected.[41] Skull fractures that go through the part of the skull containing the ear structures (the temporal bone) can also cause damage to the middle ear.[42] A cholesteatoma is a cyst of squamous skin cells that may develop from birth or secondary to other causes such as chronic ear infections. It may impair hearing or cause dizziness or vertigo, and is usually investigated by otoscopy and may require a CT scan. The treatment for cholesteatoma is surgery.[43] Inner ear There are two principal damage mechanisms to the inner ear in industrialised society, and both injure hair cells. The first is exposure to elevated sound levels (noise trauma), and the second is exposure to drugs and other substances (ototoxicity). A large number of people are exposed to sound levels on a daily basis that are likely to lead to significant hearing loss.[44] The National Institute for Occupational Safety and Health has recently published research on the estimated numbers of persons with hearing difficulty (11%) and the percentage of those that can be attributed to occupational noise exposure (24%).[45] Furthermore, according to the National Health and Nutrition Examination Survey (NHANES), approximately twenty-two million (17%) US workers reported exposure to hazardous workplace noise.[46] Workers exposed to hazardous noise further exacerbate the potential for developing noise-induced hearing loss when they do not wear hearing protection. Tinnitus is the hearing of sound when no external sound is present.[47] While often described as a ringing, it may also sound like a clicking, hiss or roaring.[48] Rarely, unclear voices or music are heard.[49] The sound may be soft or loud, low pitched or high pitched and appear to be coming from one ear or both.[48] Most of the time, it comes on gradually.[49] In some people, the sound causes depression, anxiety, or concentration difficulties.[48] Tinnitus is not a disease but a symptom that can result from a number of underlying causes. One of the most common causes is noise-induced hearing loss. Other causes include: ear infections, disease of the heart or blood vessels, Ménière's disease, brain tumors, emotional stress, exposure to certain medications, a previous head injury, and earwax.[48][50] It is more common in those with depression and anxiety.[49] Hyperacusis is a condition where sounds are painful, usually in the ear or from headaches.[51] Stretching of the earlobe and various cartilage piercings The ears have been ornamented with jewelry for thousands of years, traditionally by piercing of the earlobe. In ancient and modern cultures, ornaments have been placed to stretch and enlarge the earlobes, allowing for larger plugs to be slid into a large fleshy gap in the lobe. Tearing of the earlobe from the weight of heavy earrings, or from traumatic pull of an earring (for example, by snagging on a sweater), is fairly common.[52] Injury to the ears has been present since Roman times as a method of reprimand or punishment – "In Roman times, when a dispute arose that could not be settled amicably, the injured party cited the name of the person thought to be responsible before the Praetor; if the offender did not appear within the specified time limit, the complainant summoned witnesses to make statements. If they refused, as often happened, the injured party was allowed to drag them by the ear and to pinch them hard if they resisted. Hence the French expression "se faire tirer l'oreille", of which the literal meaning is "to have one's ear pulled" and the figurative meaning "to take a lot of persuading". We use the expression "to tweak (or pull) someone's ears" to mean "inflict a punishment"."[35] The auricles have an effect on facial appearance. In Western societies, protruding ears (present in about 5% of ethnic Europeans) have been considered unattractive, particularly if asymmetric.[53] The first surgery to reduce the projection of prominent ears was published in the medical literature by Ernst Dieffenbach in 1845, and the first case report in 1881.[54] Pointy ears are a characteristic of some creatures in folklore such as the French croquemitaine, Brazilian curupira[55] or Japanese earth spider.[citation needed] It has been a feature of characters on art as old as that of Ancient Greece[56] and medieval Europe.[57] Pointy ears are a common characteristic of many creatures in the fantasy genre,[58] including elves,[59][60][61] faeries,[62][63] pixies,[64] hobbits,[65] or orcs.[66] They are a characteristic of creatures in the horror genre, such as vampires.[67][68] Pointy ears are also found in the science fiction genre; for example among the Vulcan and Romulan races of the Star Trek universe[69] and the Nightcrawler character from the X-Men universe.[70] Georg von Békésy was a Hungarian biophysicist born in Budapest, Hungary. In 1961, he was awarded the Nobel Prize in Physiology or Medicine for his research on the function of the cochlea in the mammalian hearing organ.[71] The Vacanti mouse was a laboratory mouse that had what looked like a human ear grown on its back. The "ear" was actually an ear-shaped cartilage structure grown by seeding cow cartilage cells into a biodegradable ear-shaped mold and then implanted under the skin of the mouse; then the cartilage naturally grew by itself.[72] It was developed as an alternative to ear repair or grafting procedures and the results met with much publicity and controversy in 1997.[73][74] Primate earsHuman and crab-eating macaque(Darwin's tubercle highlighted) Pinnae of bats The ears of vertebrates are placed somewhat symmetrically on either side of the head, an arrangement that aids sound localization. All mammals have three auditory ossicles. The external pinna in therian mammals helps direct sound through the ear canal to the eardrum. The complex geometry of ridges on the inner surface of some mammalian ears helps to sharply focus sounds produced by prey, using echolocation signals. These ridges can be regarded as the acoustic equivalent of a Fresnel lens, and may be seen in a wide range of animals, including the bat, aye-aye, lesser galago, bat-eared fox, mouse lemur and others.[75][76][77] Some large primates such as gorillas and orangutans (and also humans) have undeveloped ear muscles that are non-functional vestigial structures, yet are still large enough to be easily identified.[78] An ear muscle that cannot move the ear, for whatever reason, has lost that biological function. Man able to move his earThis serves as evidence of homology between related species. In humans, there is variability in these muscles, such that some people are able to move their ears in various directions, and it has been said that it may be possible for others to gain such movement by repeated trials.[78] In such primates, the inability to move the ear is compensated for mainly by the ability to easily turn the head on a horizontal plane, an ability which is not common to most monkeys—a function once provided by one structure is now replaced by another.[79] In some animals with mobile pinnae (like the horse), each pinna can be aimed independently to better receive the sound. For these animals, the pinnae help localise the direction of the sound source. African bush elephantLoxodonta africana Fennec fox (desert regions)Vulpes zerda Arctic foxVulpes lagopus Domestic rabbit – French Lop breedOryctolagus cuniculus Half-Lop RabbitIllustration byCharles Darwin, 1868 The ear, with its blood vessels close to the surface, is an essential thermoregulator in some land mammals, including the elephant, the fox, and the rabbit.[80] There are five types of ear carriage in domestic rabbits, some of which have been bred for exaggerated ear length[81]—a potential health risk that is controlled in some countries.[82] Abnormalities in the skull of a half-lop rabbit were studied by Charles Darwin in 1868. In marine mammals, earless seals are one of three groups of Pinnipedia. Only vertebrate animals have ears, though many invertebrates detect sound using other kinds of sense organs. In insects, tympanal organs are used to hear distant sounds. They are located either on the head or elsewhere, depending on the insect family.[83] The tympanal organs of some insects are extremely sensitive, offering acute hearing beyond that of most other animals. The female cricket fly Ormia ochracea has tympanal organs on each side of her abdomen. They are connected by a thin bridge of exoskeleton and they function like a tiny pair of eardrums, but, because they are linked, they provide acute directional information. The fly uses her "ears" to detect the call of her host, a male cricket. Depending on where the song of the cricket is coming from, the fly's hearing organs will reverberate at slightly different frequencies. This difference may be as little as 50 billionths of a second, but it is enough to allow the fly to home in directly on a singing male cricket and parasitise it.[84] Simpler structures allow other arthropods to detect near-field sounds. Spiders and cockroaches, for example, have hairs on their legs, which are used for detecting sound. Caterpillars may also have hairs on their body that perceive vibrations[85] and allow them to respond to sound. Hear, hear Hearing test Righting reflex Eustachian tube – The tube which connects the middle ear to the throat ^ "Ear". Oxford Dictionary. Archived from the original on 18 July 2012. Retrieved 25 February 2016. ^ a b c d Standring, Susan (2008). Borley, Neil R. (ed.). Gray's Anatomy: The Anatomical Basis of Clinical Practice (40 ed.). Edinburgh: Churchill Livingstone/Elsevier. pp. Chapter 36. "External and middle ear", 615–631. ISBN 978-0-443-06684-9. Alt URL ^ a b c d e f g Drake, Richard L.; Vogl, Wayne; Tibbitts, Adam W.M. Mitchell; illustrations by Richard; Richardson, Paul (2005). Gray's anatomy for students. Philadelphia: Elsevier/Churchill Livingstone. pp. 855–856. ISBN 978-0-8089-2306-0. ^ Shmerling, Robert H. (17 May 2017). "3 reasons to leave earwax alone". 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Oxford University Press The dictionary definition of ear at Wiktionary Media related to Ears at Wikimedia Commons Retrieved from " Etymology Noun (1) Middle English ere, from Old English ēare; akin to Old High German ōra ear, Latin auris, Greek ous Noun (2) Middle English er, ere, going back to Old English ēar (Northumbrian æhher), going back to Germanic *ahaz (whence also Old Frisian ār "ear of grain," Middle Dutch aer, aere, Old Saxon ehir, Old High German ah, ahar, ehir, Old Norse ax, Gothic ahs), going back to Indo-European *h2ek-es-, s-stem derivative from the base *h2ek- "sharp, pointed" (in reference to a spike of grain perhaps originally referring to the awns, then generalized to the entire spike), whence also Latin acer-, acus "husks of grain or legumes, chaff," Tocharian B āke "end," Tocharian A āk — more at edge entry 1 Note: The diverse outcomes in Germanic assume generalization throughout the paradigm of the original stem variants: most forms from oblique stems *ahuz-, ahiz-, but Old High German ah, from nominative *ahaz and Old Norse ax, Gothic ahs, from a syncopated stem *ah-sa-. Verb Middle English eren, derivative of ere ear entry 2 First Known Use Noun (1) before the 12th century, in the meaning defined at sense 1a Noun (2) before the 12th century, in the meaning defined above Verb 14th century, in the meaning defined above Time Traveler The first known use of ear was before the 12th century See more words from the same century The outer, middle, and inner ear have unique structures that help with hearing and balance.Many ear problems like tinnitus, infections, and wax buildup can affect hearing and balance.Protect your ears by avoiding loud sounds, turning down headphones, and using protection when swimming. The ears are a pair of sensory organs whose primary functions are hearing and balance. They are divided into three portions: the outer ear, the middle ear, and the inner ear. Each has an intricate structure of bones, nerves, and muscles. Just like other parts of the body, the ears can be affected by bacterial and viral infections, as well as disease. Healthcare providers use a variety of tools to examine the ears and measure how well they're functioning. The ears are two sensory organs. They are located at the sides of the head, directly over a person's temporal lobe, a part of the brain. They have two main functions: hearing and balance. Each ear is divided into an outer, middle, and inner section that have distinct structures. The outer ear includes two parts: Auricle: Also known as the pinna, this is the outer portion of the ear. It is composed of skin and cartilage and attaches to the skull. External acoustic meatus: Also called the external auditory canal, this tube leads from the outside of the ear to the eardrum. Its outer portion is surrounded by cartilage, and the inner part is surrounded by the bones of the skull. The tympanic membrane (eardrum) is the border between the outer and middle ear. It is composed of a membrane attached by fibrous cartilage to the surrounding bone. The inner surface is curved toward the middle ear and connects with the malleus bone. The middle ear (also known as the tympanum or tympanic cavity) starts on the other side of the eardrum. It is a narrow tube with concave walls that is separated from the inner ear by its labyrinthine (medial) wall. Three small ossicles (bones) in the middle ear transmit vibrations to the inner ear: Malleus (hammer), which is attached to the eardrumIncus (anvil), which is attached to the malleusStapes (stirrup), which is attached to the incus and is also the smallest bone in the human body The eustachian tube connects the middle ear to the upper throat and nasal cavity. It's lined with mucous and helps regulate pressure around the eardrum so that sound waves can be transferred. The inner ear is a bony labyrinth that is filled with a fluid called perilymph. The major structures of the inner ear include: Vestibule: A cavity that contains two sacs (the utricle and the saccule) which are receptors for balanceCochlea: A spiral-shaped organ that consists of three compartments that contain critical nerves for hearingSemicircular canals: Three semi-circular canals that contain balance receptors Ears can vary, so what's considered normal anatomy of the inner or outer ear in one person may be different for another. For example, 19% to 54% of people have an attached earlobe, which is a genetic variation. The shape of the outer ear directs sound waves from the environment to the ear canal. These waves are then directed toward the tympanic membrane (eardrum), which causes it to vibrate. The vibration passes on to the malleus, incus, and stapes, which leads the perilymph within the cochlea to vibrate. This stimulates tiny hairs on the organ of Corti, a small structure in the cochlea. This stimulation is translated into electrical signals that are delivered to the auditory nerves of the brain for processing. Sense of balance and position is regulated by the semicircular canals in the inner ear. Each is filled with fluid and sensors. When your head changes position, the fluid moves and also moves the sensors. Those sensors transmit information on your position along the vestibular nerve to your brain. Your brain uses this intel to send signals to your muscles to keep you balanced. As the head rotates, the endolymph is displaced, exciting the cells and generating a sense of balance. Many health conditions can affect how the ear functions. These include: Tinnitus: Persistent ringing, roaring, hissing, or buzzing in one or both ears. Tinnitus may be caused by many different factors including age-related hearing loss, overexposure to loud noises, physical injury, Meniere's disease, brain tumors, and certain medicines. Meniere's disease: Also known as idiopathic endolymphatic hydrops. This inner-ear disorder can cause vertigo, tinnitus, fluctuations in hearing ability, pain, headaches, nausea, and other symptoms. Otitis Media: An infection of the middle ear that can cause ear pain and pressure, as well as a fever Otitis Externa (Swimmer's ear): A bacterial or fungal infection in the ear canal that results in ear pain and pressure as well as a fever Cerumen: Excessive wax build-up that blocks passages between the outer and middle ear and affects hearing Auricular hematoma: Also called cauliflower ear. This is a collection of blood in the outer ear that is usually the result of trauma or injury. Ruptured tympanic membrane: A hole in the eardrum caused by infection, a loud noise, trauma, or a foreign object Eustachian tube dysfunction: When the lining of the eustachian tube is swollen, preventing it from working properly to equalize pressure Perichondritis: An infection of the tissue that surrounds the outer ear's cartilage See a healthcare provider if you or your child experience any of the following symptoms: Ear pain (with or without a fever)Muffled hearingA feeling of pressure or fullness in your earsItchiness in the ear(s)Fluid coming out of ears A healthcare provider may use one or more of these tools and tests to assess the ear and its functioning: Otoscopy: This examination of the ear canal and eardrum uses a tool called an otoscope Pure-tone test: This hearing evaluation involves patients wearing headphones and raising a hand if and when they hear certain tones. Speech test: Hearing loss is sometimes evaluated by having people repeat certain words or phrases played at specific volumes Tympanometry: This test checks the motion and health of the tympanic membrane and middle ear by pushing air into the ear and measuring the pressure with a probe. Acoustic reflex measure: This test stimulates some of the musculature in the middle ear to see if there's a weak or absent response, which indicates hearing loss. Static acoustic impedance: This test can find an eardrum rupture, fluid build-up, and blockage by measuring the air in the ear canal. Auditory brainstem response (ABR) test: A test of inner ear function (as well as neural pathways), this examination involves using electrodes on the skin to measure brain activity in response to stimuli. Otoacoustic emissions (OAE): This hearing test is performed by inserting a small, sound-emitting probe into the ear and measuring the response. Verywell Here are some simple steps you can take to keep your ears healthy: Avoid or limit exposure to excessively loud sounds.Turn the volume down when listening through headphones.Use hearing protection.Use a bathing cap, earplugs, or custom-fitted swim molds when swimming.Dry ears thoroughly after swimming or showering.Do not use any foreign object (including cotton swabs) to clean your ear canal.