

# Anatomy and Physiology: Ear, Nose and Throat

## CHAPTER 1

**D**isorders that affect the structures of the head and neck can vary greatly, from relatively minor issues to some of the most complex and challenging conditions encountered. The special senses of the ear, nose and throat are crucial for daily living; they often go unnoticed until a problem arises. These senses are integral to functions such as hearing, balance, smell, taste and breathing. When affected, these conditions can profoundly impact a person's quality of life, influencing communication, eating, sleeping and overall well-being (Harkin 2019).

The sensory organs, such as the eyes and ears, transmit information to the brain, enabling us to understand and perceive the world around us. The eyes and ears serve as the pathways through which visual and auditory stimuli reach the brain.

The problems of the ear, nose and throat are very common; most people will experience nosebleeds, sore throats or earaches at some point in their lives. Many of these issues are successfully managed at home, often with the advice of a pharmacist or general practice nurse/general practitioner. However, some ear, nose and throat problems can be life-threatening, requiring an immediate visit to an emergency department, GP surgery and sometimes a period of nursing care at home following discharge.

When diseases or trauma affect these organs, they can compromise a person's ability to maintain a safe environment and hinder their capacity to perform daily activities. Mobility may become restricted, and coupled with impaired communication, this can lead to social isolation and loneliness. Such conditions can create challenges related to safety, independence, communication and relationships with others (Meakin and Seewoodhary 2022).

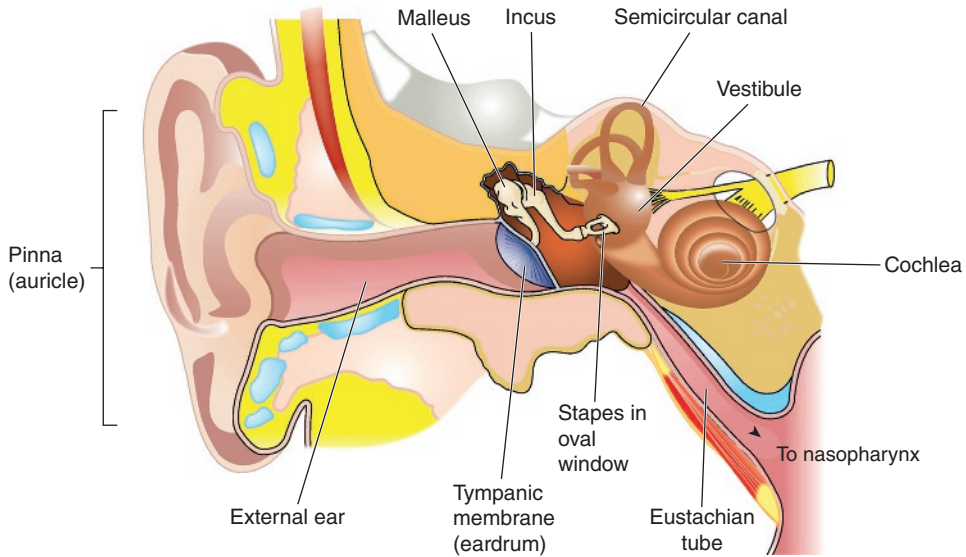
To offer care and support to patients with ear, nose and throat problems effectively in a home or hospital setting, a fundamental knowledge of the anatomy and physiology of these structures is essential, along with a thorough understanding of the clinical features of common disorders.

This chapter provides an introduction to the anatomy and physiology of the ear, nose and throat. It will explore the intricate structures and functions of these organs, explaining how they work together to support the senses and daily activities. By understanding the underlying anatomy and physiology, those who offer care and support will gain a deeper appreciation of the importance of maintaining the health of the ear, nose and throat and the impact that disorders in these areas can have on overall health and daily functioning.

### **ANATOMY AND PHYSIOLOGY OF THE EAR**

The ear is a complex organ. The ear is divided into three main distinct sections (see Figure 1.1):

1. External (outer)
2. Middle
3. Inner



**FIGURE 1.1** Ear

Each of these sections plays a crucial role in the process of hearing. Additionally, the inner ear is vital for maintaining the sense of balance.

## EXTERNAL EAR

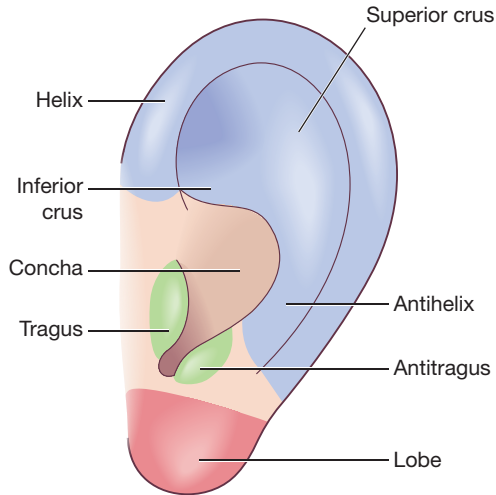
This aspect of the ear assists with the functions of the middle ear, although it is not an anatomical part of it. The external ear is also known as the outer ear, which consists of two main parts:

1. **Auricle (pinna):** The visible part of the ear that is located outside the head. It is made of cartilage and skin and its primary function is to collect sound waves from the environment and direct them into the ear canal.
2. **External auditory canal (ear canal):** A tube-like structure that extends from the auricle to the eardrum (tympanic membrane). It serves as a pathway for sound waves to travel from the auricle to the middle ear. The canal also helps protect the eardrum from foreign objects and infections.

The auricle and external acoustic meatus (external auditory canal) make up the external ear. The external ear collects and amplifies sound, which is transmitted to the middle ear. The asymmetrical shape introduces delays in the path of sound, which assist in sound localisation (see Figure 1.2).

The arterial blood supply is composed of the posterior auricular artery, the anterior auricular branch of the superficial temporal artery and the occipital artery. Veins accompany corresponding named arteries.

The external ear is supplied by the auriculotemporal (fifth cranial) nerve and contributions from cranial nerves VII, IX and X and the great auricular nerve.



**FIGURE 1.2** Outer ear

## MIDDLE EAR

The key function of the middle ear (tympanic cavity) is bony conduction of sound via the transference of sound waves in the air collected by the auricle to the fluid of the inner ear (Peate 2022). The middle ear extends from the tympanic membrane to the oval window, containing the bony conduction elements of the ossicles. The walls of the tympanic cavity are complex with important associations. The middle ear is an airspace lined with a mucous membrane; it is connected to the nasopharynx by the eustachian tube, thus allowing for the equalisation of air pressure between the middle ear and the throat (and therefore atmospheric air). This equalisation of pressure ensures free movement of the tympanic membrane in response to sound waves conducted along the external ear canal.

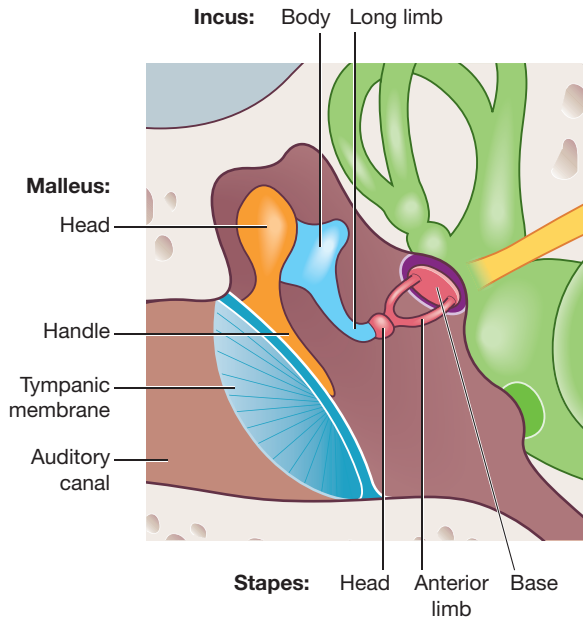
Within the middle ear are three bones (the ossicles or ossicular chain) (see Figure 1.3):

- Hammer (malleus)
- Anvil (incus)
- Stirrup (stapes)

These interlink and are connected with the tympanic membrane. Vibrations of the tympanic membrane are conducted along the bones to the oval window; these vibrations are then transmitted via the oval window into the fluid of the inner ear. Movement in this fluid leads to stimulation of the hearing receptors.

## TYMPANIC MEMBRANE

The tympanic membrane is a thin, oval, semi-transparent membrane that separates the external ear from the middle ear. It receives air vibrations collected by the auricle and transfers them to the mobile tympanic membrane, which then passes the sound to the ossicles. The tympanic cavity contains various structures, including muscles, nerves and the eustachian tube.



**FIGURE 1.3** Middle ear

## OSSICLES

A chain of movable bones called the ossicles – the malleus (hammer), incus (anvil) and stapes (stirrup) – extends from the deep surface of the tympanic membrane to the oval window. These bones transmit and amplify sound waves from the air to the perilymph in the inner ear.

## AUDITORY TUBE

The auditory tube or eustachian tube connects the middle ear to the nasopharynx. Its main function is to equalise pressure across the tympanic membrane.

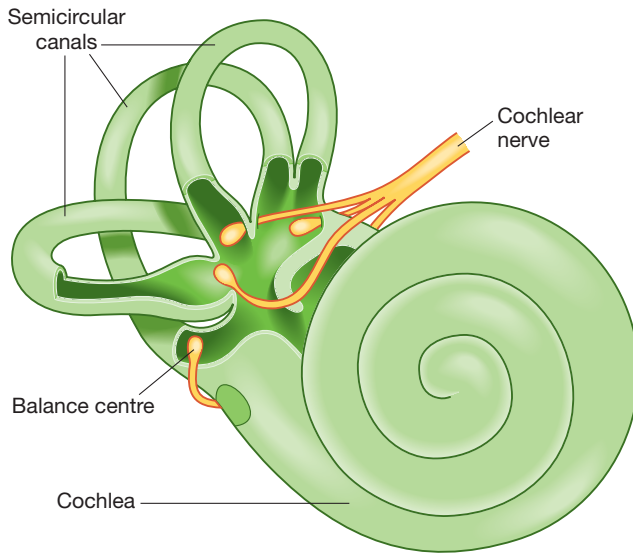
## BLOOD SUPPLY AND INNERVATION

The blood supply to the middle ear comes from several arteries, primarily from the external and internal carotid arteries. The auriculotemporal nerve (fifth cranial nerve), the tympanic nerve (ninth cranial nerve) and the auricular branch of the vagus nerve innervate the middle ear.

## INNER EAR

The inner ear is also known as the labyrinth due to its complex network of canals. It consists of a membranous labyrinth that is enclosed within an osseous (bony) labyrinth. The vestibule and semicircular canals are involved in vestibular function (balance), while the cochlea, which is a coiled tube, is responsible for hearing (see Figure 1.4).

A layer of dense bone outlines the inner ear's surface. The walls of the bony labyrinth are continuous with the surrounding temporal bone and they closely follow the contours of the membranous labyrinth, which is a delicate, interconnected network of fluid-filled tubes that houses sensory receptors.



**FIGURE 1.4** Inner ear

**Table 1.1** The physiology of hearing – an overview

Component	Discussion
Sound wave capture	Sound waves are captured by the pinna and directed into the ear canal.
Eardrum vibration	Sound waves cause the eardrum to vibrate.
Ossicle movement	The vibrations are transmitted to the ossicles, which amplify and transfer them to the oval window of the cochlea.
Fluid motion in cochlea	The movement of the stapes at the oval window creates pressure waves in the fluid (endolymph) within the cochlea.
Hair cell stimulation	These pressure waves cause the basilar membrane (on which the organ of Corti rests) to move, bending the hair cells. The bending of hair cells opens ion channels, creating electrical signals.
Signal transmission to brain	These electrical signals are transmitted to the brain via the auditory nerve, where they are interpreted as sound.

Source: Adapted from Meakin and Seewoodhary (2022); Harkin (2019).

Apart from two small areas near the cochlear spiral, the walls of the bony labyrinth are made of dense bone. The round window is a thin, membranous partition that separates the perilymph of the cochlear chambers from the air-filled middle ear. Collagen fibres connect the bony margins of the oval window to the base of the stapes.

Perilymph, a fluid similar to cerebrospinal fluid, flows between the bony and membranous labyrinths, while endolymph is contained within the membranous labyrinth. These fluids occupy separate compartments. The bony labyrinth can be divided into the vestibule, three semicircular canals and the cochlea.

## PHYSIOLOGY OF HEARING

The process of hearing involves a number of steps. An overview of these steps is outlined in Table 1.1.

## THE ORGAN OF CORTI

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The organ of Corti is essential for hearing. It converts mechanical sound vibrations into electrical signals that the brain can understand. Hair cells within this organ detect these vibrations and send information through the auditory nerve to the brain, enabling the perception of sound.

## PHYSIOLOGY OF BALANCE

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The vestibular system that comprises the vestibule and semicircular canals is essential for helping us to maintain balance and understand our spatial orientation.

## LINEAR ACCELERATION AND HEAD POSITION

The utricle and saccule detect linear acceleration and the position of the head relative to gravity. These are two sac-like structures located in the vestibule of the inner ear.

They contain sensory hair cells embedded in a gel-like substance, topped with tiny calcium carbonate crystals that are called otoliths. Movement of the otoliths stimulates hair cells, sending signals to the brain about head position and movement.

Linear acceleration refers to movement in a straight line, such as moving forward, backward, up or down. Head position relative to gravity refers to the orientation of the head (e.g. tilted up, down or to the side).

## ROTATIONAL MOVEMENTS

This refers to how the semicircular canals in the vestibular system of the inner ear detect rotational movements of the head. The information is processed and transmitted to the brain, aiding in maintaining balance and coordinating movements.

There are three semicircular canals in each ear, oriented at roughly right angles to each other: anterior, posterior and lateral canals. Each canal is filled with a fluid that is called endolymph and has a swelling at its base called the ampulla. Rotational movements refer to the turning or spinning of the head, such as nodding, shaking or tilting the head to the side.

When the head rotates, the endolymph (fluid) inside the semicircular canals lags behind the movement of the canal walls due to inertia. This lag occurs because the fluid initially resists the change in motion.

Within the ampulla of each semicircular canal, there are sensory hair cells that are embedded in a gel-like structure called the cupula. As the head rotates and the canal moves, the lagging endolymph pushes against the cupula; this causes it to bend. This bending of the cupula bends the hair cells embedded within it. The bending of hair cells opens ion channels, generating electrical signals (nerve impulses). These electrical signals are then transmitted via the vestibular nerve to the brain. The brain interprets these signals to understand the direction and speed of the head's rotational movement (see Box 1.1).

**BOX 1.1****ROTATION OF THE HEAD****Turning the head**

When you turn your head to the left or right, the endolymph in the semicircular canals initially stays in place due to inertia. This causes the cupula to bend in the direction opposite to the head turn, bending the hair cells and generating nerve impulses.

**Spinning around**

If you spin around in a circle, the endolymph eventually begins to move with the canals, but when you suddenly stop spinning, the fluid will continue to move due to inertia. This continued movement bends the cupula and hair cells in the opposite direction, creating a sensation of continued spinning even though you have stopped.

**INTEGRATION OF HEARING AND BALANCE**

The auditory and vestibular systems work closely with the brain to process sensory information. The brain integrates auditory information to perceive and localise sound, while vestibular information helps in maintaining balance, posture and spatial orientation. This integration ensures there are coordinated movements and stability, allowing for effective interaction with the environment.

Understanding the anatomy and physiology of the ear provides insight into its crucial role in hearing and balance, emphasising the complexity and intricacies associated with this vital sensory organ.

Meakin and Seewoodhary (2022) provide a summary of the structures and functions of the ear, which is provided in Table 1.2. Figure 1.5 offers an overview of the mechanism of hearing.

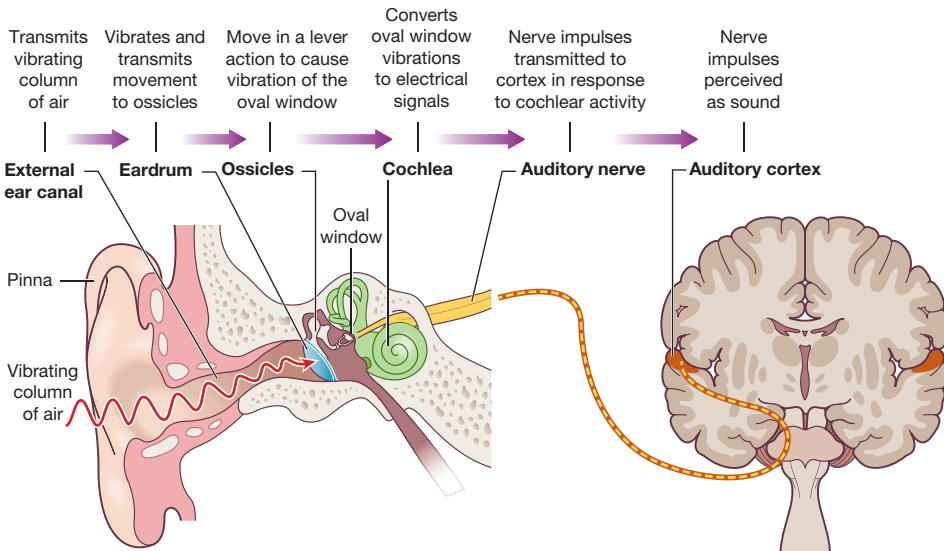
**Table 1.2** The structures and functions of the ear

Name	Structure	Function
Auricle (pinna)	Composed of folds of skin over cartilage	Collects sound, channelling it down the ear Helps to determine the direction of sound Protects internal aspects of the ear
External acoustic meatus (ear canal)	A tube (about 2.5 cm) leading from the pinna to the tympanic membrane	Directs sound waves towards the tympanic membrane Secretes cerumen (a waxy substance) and sebum to protect and lubricate the ear
Tympanic membrane	Located between the external ear and the middle ear	Vibrates with the same frequency as the sound wave that hits it Provides airtight protection between the external and middle ear
Ear ossicles	Three bones in the middle ear: malleus, incus and stapes	Transfer the vibrations from the tympanic membrane to the middle of the ear to the oval window

(Continued)

**Table 1.2** (Continued)

Name	Structure	Function
Oval window	A thin membrane situated between the middle and inner ear	Receives the vibration from the tympanic membrane via the ossicles
Round window	Sited just below the oval window	Acts like a piston, transferring the vibration from the oval window to the fluid in the inner ear
Cochlea	A long tube wound around itself and filled with liquid	The fluid in the cochlea transfers the vibrations to the hairs in the organ of Corti
Organ of Corti	Situated inside the cochlea contains receptors and hair cells connected to nerves	Hairs are tuned to a certain wave frequency. When the waves pass over the hairs, an electrical signal is triggered
Auditory nerve VIII	A bundle of nerve fibres	Sends the electrical signals to the brain for interpretation
Eustachian tube	A long narrow tube opening into the middle ear, leading to the pharynx	Equalises the pressure between the outer and inner ear

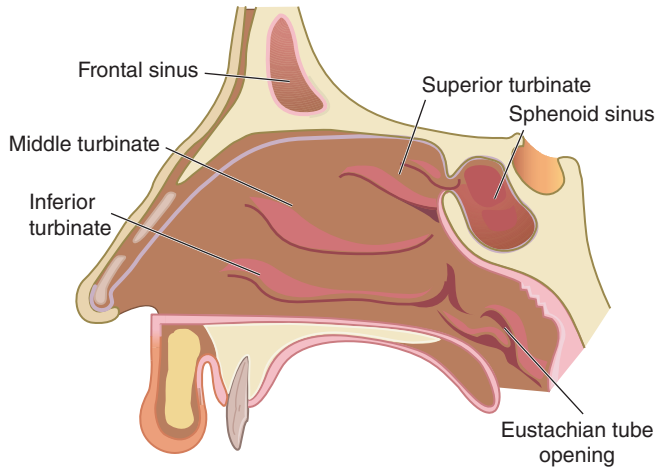


**FIGURE 1.5** The mechanism of hearing

## ANATOMY AND PHYSIOLOGY OF THE NOSE

The nose is the first part of the respiratory tract and houses the receptors for the sense of smell (see Figure 1.6). Its functions are threefold:

- Warming, moistening and filtering inhaled air
- Detecting olfactory stimuli
- Acting as a resonance chamber to modify the quality of speech



**FIGURE 1.6** Nose

The primary function of the nose is to serve as a conduit for air entering and exiting the respiratory tract. In this role, it acts as an ‘air conditioner’, ensuring that inhaled air is humidified, warmed, filtered and free of particulate matter. The nose can be divided into external and internal sections:

### EXTERNAL NOSE

The external nose consists of a framework of bone and cartilage covered by muscle and skin and lined with a mucous membrane. This framework is attached to the frontal and maxillary bones of the skull. The external nose is divided by the septum into two airways (nares or nostrils) of roughly equal size, which are part of the bone and cartilage structure.

### INTERNAL NOSE

The internal nose is a large chamber lined with a ciliated mucous membrane and contains coarse hairs that filter out large particles from inhaled air. Finer particles that enter the nose become trapped in the sticky mucus that is produced by the membrane and are then transported to the nasopharynx by the ciliary system. The internal nose is divided into two by a continuation of the septum. Each side contains three shelves formed by projections of bone known as the turbinates, which increase the surface area that inhaled air must pass over. The internal nose has an extremely rich vascular supply which, in conjunction with the turbinates, maximises the humidification and warming of the air passing through. Additionally, the internal nose contains openings (ostia) from the sinus cavities that are located within the bones of the skull.

### HUMIDIFICATION

The inner lining of the nasal cavity is covered with mucous membranes that secrete mucus. This mucus adds moisture to the inhaled air; this helps to ensure that the air reaching the lungs is appropriately humidified. This is crucial because dry air can irritate the delicate

tissues of the respiratory tract, and this can reduce the efficiency of gas exchange in the lungs.

## WARMING

The nasal cavity has an extensive network of blood vessels just beneath the mucous membranes. As air passes through the nasal passages, it comes into close contact with the warm blood that is flowing through these vessels. This process helps to warm the air to body temperature before it reaches the lower respiratory tract. Warming the air is important because cold air can constrict the airways, impairing respiratory function.

## FILTRATION

The entrance of the nasal cavity is lined with tiny hairs that are called vibrissae that trap large particles such as dust and debris; this prevents them from entering the respiratory tract. Deeper in the nasal cavity, mucus traps smaller particles, including pollen, bacteria and other pathogens. Tiny hair-like structures that are called cilia move in a coordinated manner to transport mucus and trapped particles towards the throat, where they can be swallowed or expelled. This filtration mechanism helps to protect the lungs from inhaled contaminants.

## REMOVAL OF PARTICULATE MATTER

Nasal conchae (turbinates) are bony structures covered with mucous membrane that protrude into the nasal cavity; they create turbulence in the airflow. This turbulence increases the contact between the air and the mucous membranes, enhancing the air's warming, humidifying and filtering processes. Particulate matter, such as dust and microorganisms, is more likely to be trapped in the mucus due to this turbulent flow.

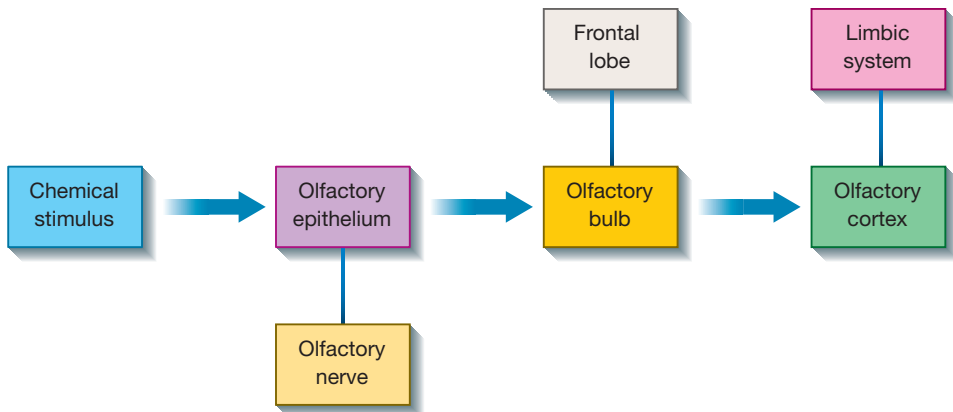
If particulate matter, such as dust or pollen, irritates the nasal mucosa, the body triggers a sneeze reflex. Sneezing is a forceful expulsion of air. When sneezing occurs, trapped particles are discharged from the nasal passages that aim to effectively clear the nose and protect the respiratory tract.

## OLFACTION

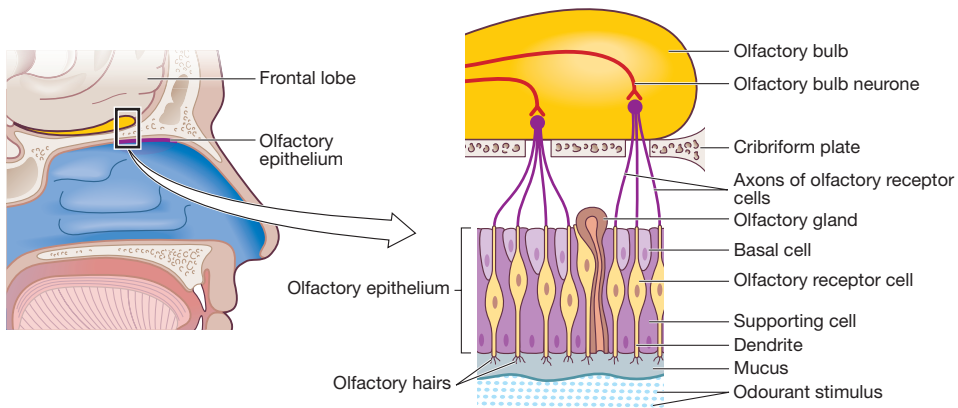
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Olfaction refers to the sense of smell, which, along with taste, is a chemical sense. The nose contains between 10 and 100 million olfactory receptor neurones, located in the olfactory epithelium lining the nasal cavity's mucosa. The sensations arise from the interaction of molecules with smell receptors (see Figure 1.7). Some smells can evoke strong emotional responses as the olfactory impulse spreads to the limbic system. When a person is continuously exposed to an odour, their perception of it will diminish and cease within minutes; this loss of perception only affects that specific odour.

The sense of smell allows us to evaluate our environment by taking in a large amount of information. We constantly assess the air we inhale, which can alert us to potential dangers, such as the presence of smoke. Smell also helps us determine the quality of food, indicating whether it is edible or potentially poisonous (rotten or spoiled). Additionally, it enables us to identify the presence of another being and influences social and sexual behaviour. Humans have an innate ability to detect bad, unpleasant or dangerous smells. The sense of smell is crucial for survival and quality of life.



**FIGURE 1.7** The pathway of smell



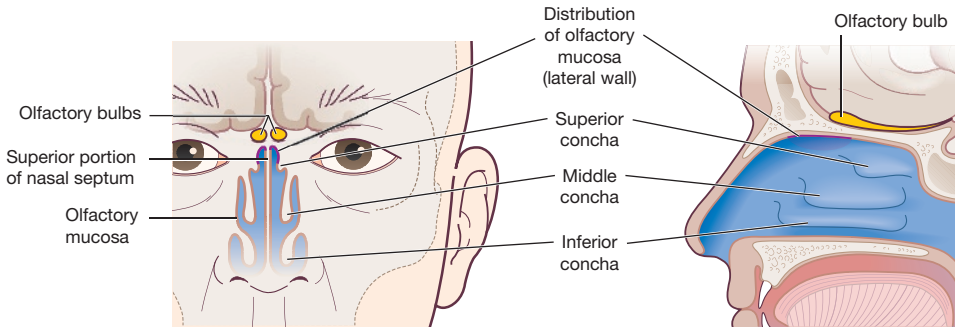
**FIGURE 1.8** Olfactory epithelium and olfactory receptor cells

## OLFACTORY SYSTEM STRUCTURE

**Olfactory Receptor Cells** The olfactory system begins with olfactory receptor cells situated in the nasal epithelium. Above these cells is a protective layer of bone. Axons from these receptor cells merge to form the olfactory nerves, with the ends of the axons forming spherical glomeruli. Each glomerulus receives input from the same type of olfactory receptor. Dendrites from mitral cell neurones permeate the glomerular layer and transmit information to the olfactory bulb in the cerebral cortex.

**Olfactory Epithelium** The specialised receptor cells, known as olfactory receptor neurones, detect smells. This process relies on odourant molecules binding to receptors on these cells. The olfactory epithelium, located in the nasal mucosa, contains sensory cells and Bowman's glands, which produce a secretion covering the receptors. This secretion includes mucopolysaccharides, immunoglobulins, proteins (such as lysozyme) and various enzymes.

The nasal mucosa also contains pigmented epithelial cells, although the reason for their pigmentation is unknown. The receptor cells in the nasal epithelium possess terminal enlargements with approximately 8–20 olfactory cilia containing smell receptors (see Figure 1.8).



**FIGURE 1.9** The olfactory bulb (nerve)

**Olfactory Nerve and Cribriform Plate** Small, unmyelinated axons from olfactory receptor cells form the fine fibres of the first cranial nerve, which travel centrally to the ipsilateral olfactory bulb to connect with second-order neurones. The trigeminal nerve (cranial nerve V) is involved in detecting caustic chemicals, such as ammonia, through its sensory fibres in the nasal cavity. The cribriform plate of the ethmoid bone, separated at the midline by the crista galli, has small foramina through which olfactory nerve fibres pass.

**Olfactory Bulbs** The olfactory bulb, located below the basal frontal lobe, is a highly organised structure with several distinct layers and synaptic specialisations:

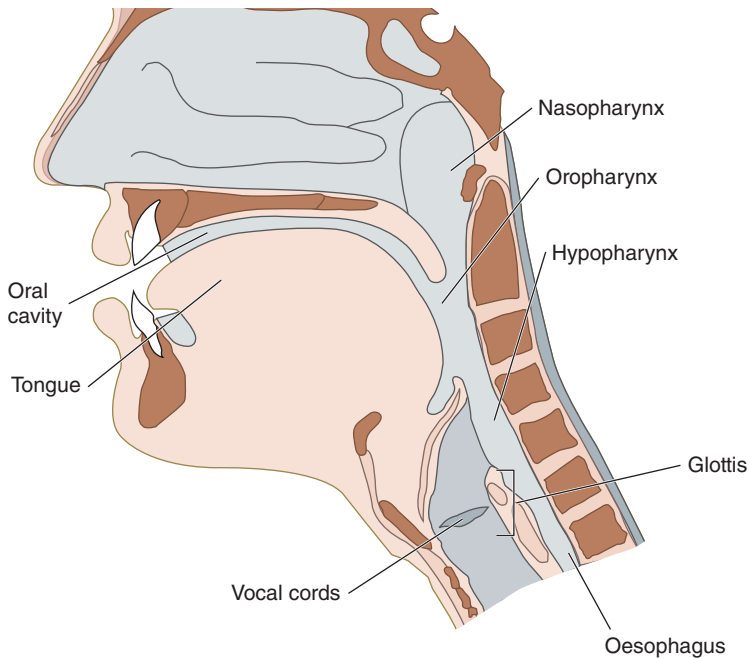
- Glomerular layer
- External plexiform layer
- Mitral cell layer
- Internal plexiform layer
- Granule cell layer

**Olfactory Tract** Mitral cell axons carry smell information from the olfactory bulb to the olfactory cortex via the olfactory tract. Some of these axons also connect to the anterior olfactory nucleus and the septal area. Additionally, some nerve fibres from one olfactory bulb cross over to the other side of the brain through a structure called the anterior commissure, allowing for communication between the two olfactory bulbs. Figure 1.9 demonstrates the olfactory bulb.

## RESONANCE OF THE VOICE

The nasal cavity significantly contributes to the resonance of the voice by amplifying and enriching vocal tones as air passes through during speech. This process enhances the unique quality of each individual's voice, influences speech clarity and affects the articulation of nasal sounds.

The nose is a vital component of the respiratory system with multifaceted functions. Beyond serving as a passageway for air, it plays a critical role in conditioning the air we breathe by humidifying, warming and filtering it. Additionally, the nose helps in protecting the respiratory tract from particulate matter and pathogens, while also contributing to the sense of smell and the resonance of speech. Understanding the nose's complex functions highlights its importance in maintaining respiratory health and overall well-being.



**FIGURE 1.10** Throat

## **ANATOMY AND PHYSIOLOGY OF THE THROAT**

The throat is anatomically referred to as the pharynx and the larynx. The pharynx can be divided into three sections: the nasopharynx, oropharynx and hypopharynx (see Figure 1.10).

The throat plays an important role in both the respiratory and digestive systems.

## **THE ANATOMY OF THE THROAT**

### **THE PHARYNX**

The pharynx is a muscular tube that serves as a pathway for both air and food. It is divided into three regions:

- a.** **Nasopharynx:** This is located behind the nasal cavity and above the soft palate; this section extends from the nasal septum to the openings of the eustachian tubes. It primarily functions as an airway and contains the pharyngeal tonsils (adenoids).
- b.** **Oropharynx:** Situated behind the oral cavity is the oropharynx; this middle part extends from the soft palate to the level of the hyoid bone. It includes the base of the tongue, the uvula and the palatine tonsils, surrounded by lymphoid tissue. It serves as a passageway for both air and food. The tonsils are five collections of lymphatic nodules mostly located in a ring around the junction of the oral cavity and the oropharynx. These are:
  - Two palatine tonsils located at the back of the oral cavity.
  - Two lingual tonsils located at the base of the tongue.
  - A single pharyngeal tonsil (adenoid) located at the junction of the nasal cavity and the nasopharynx.

The role of the tonsils is to contribute to the fight against inhaled or ingested foreign substances.

- c. Hypopharynx: This is the lowest part of the pharynx, which extends from the hyoid bone to the oesophagus. It plays a role in guiding food into the oesophagus and air into the larynx.

## LARYNX

The larynx, or the voice box, is located below the pharynx and at the top of the trachea. It is composed of cartilage (including the thyroid, cricoid and arytenoid cartilages) and muscle. The larynx is responsible for sound production and protecting the airway during swallowing. It is lined with mucosa, featuring:

- Upper part: stratified squamous epithelium, which provides protection against mechanical stress.
- Lower part: ciliated pseudostratified columnar epithelium, which helps in trapping and moving particles out of the respiratory tract.

## THE PHYSIOLOGY OF THE THROAT

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### RESPIRATORY FUNCTION

The pharynx serves as a conduit for air from the nasal cavity to the larynx and subsequently to the trachea. The larynx regulates the flow of air and protects the lower airways by closing during swallowing, preventing aspiration of food and liquids.

### DIGESTIVE FUNCTION

The oropharynx and hypopharynx facilitate the movement of food from the mouth to the oesophagus. During swallowing, the soft palate elevates to close off the nasopharynx, preventing food from entering the nasal cavity. The epiglottis, a large flap of cartilage, covers the opening of the laryngeal inlet, directing food towards the oesophagus during swallowing (deglutition), thus protecting the airway.

### VOICE PRODUCTION

The larynx houses the vocal cords (vocal folds), which vibrate and in so doing they produce sound as air passes through them. The tension and length of the vocal cords are controlled by laryngeal muscles; this determines the pitch and volume of the sound. Resonance is provided by the pharynx, oral and nasal cavities. The mucous membrane of the larynx is formed to create two pairs of folds:

1. Ventricular folds (false vocal cords): When brought together, they enable the holding of the breath against the pressure in the thoracic cavity, such as when lifting a heavy object.
2. Vocal cords (folds; true vocal cords): Situated below the ventricular folds, the vocal cords are fundamental to the generation of speech. Sound is generated by the vibration of these cords, but the mouth, nasal cavity and nasal sinuses are also required to create recognisable speech.

## IMMUNE FUNCTION

The lymphoid tissues located in the pharynx, including the tonsils and adenoids, play a role in immune defence. They help to trap and destroy pathogens entering through the mouth or nose.

In summary, the throat's intricate anatomy and its multifaceted physiology support its essential roles in breathing, swallowing, voice production and immune defence.

## CONCLUSION

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Understanding the anatomy and physiology of the ears, nose and throat is crucial for realising their roles in various bodily functions and how they interconnect to maintain overall health. The ear is intricately designed to facilitate hearing and balance, with its outer, middle and inner sections each playing distinct yet interconnected roles. The nose serves as the primary passage for air, filtering, humidifying and warming it before it reaches the lungs. It also houses the olfactory receptors, which are vital for the sense of smell. The throat, encompassing the pharynx and larynx, is a multifunctional pathway involved in respiration, digestion and vocalisation.

Each component of the ear, nose and throat system works harmoniously to perform these essential functions. The pharynx serves as a common pathway for air and food, with its divisions: the nasopharynx, oropharynx and hypopharynx, ensuring efficient processing and routing. The larynx not only protects the airway during swallowing but also produces sound, enabling speech. The Eustachian tubes maintain pressure equilibrium in the middle ear, while the tonsils and adenoids play critical roles in immune defence.

A detailed knowledge of ear, nose and throat anatomy and physiology aids in diagnosing and treating various conditions that can affect these regions, from infections and allergies to structural abnormalities and sensory impairments. By appreciating the complex structures and functions of the ears, nose and throat, those who offer people with problems concerning the ears, nose and throat can better address patient needs and contribute to maintaining and restoring health in these vital areas.

## GLOSSARY OF TERMS

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**Adenoids:** Lymphoid tissue located in the nasopharynx that helps trap and destroy pathogens.

**Auditory canal:** The passage leading from the outer ear to the eardrum.

**Cilia:** Microscopic hair-like structures in the respiratory tract that move mucus and trapped particles out of the airways.

**Cochlea:** A spiral-shaped cavity in the inner ear that contains the organ of Corti, responsible for hearing.

**Epiglottis:** A flap of cartilage at the root of the tongue, which covers the larynx during swallowing to prevent food from entering the airway.

**Eustachian tube:** A tube that connects the middle ear to the nasopharynx and helps equalise pressure on both sides of the eardrum.

**Facial nerve:** The seventh cranial nerve, responsible for facial expressions and the sense of taste in the anterior two-thirds of the tongue.

**Glottis:** The part of the larynx consisting of the vocal cords and the opening between them.

**Hyoid bone:** A U-shaped bone in the neck that supports the tongue and its muscles.

**Hypopharynx:** The lower part of the pharynx that directs food into the oesophagus.

**Incus:** One of the three small bones (ossicles) in the middle ear, also known as the anvil.

**Labyrinth:** The complex system of fluid-filled channels in the inner ear responsible for hearing and balance.

**Larynx:** The voice box, located at the top of the trachea, involved in breathing, producing sound and protecting the trachea against food aspiration.

**Malleus:** One of the three ossicles in the middle ear, also known as the hammer.

**Mastoid process:** The bony prominence behind the ear that contains air cells connected to the middle ear.

**Nasopharynx:** The upper part of the pharynx, connecting with the nasal cavity above the soft palate.

**Nasal septum:** The partition dividing the nasal cavity into two nostrils.

**Oropharynx:** The middle part of the pharynx located behind the oral cavity, extending from the soft palate to the hyoid bone.

**Ossicles:** The three small bones in the middle ear (malleus, incus, stapes) that transmit sound vibrations from the eardrum to the inner ear.

**Pharynx:** The muscular tube that connects the nasal and oral cavities to the larynx and oesophagus, comprising the nasopharynx, oropharynx and hypopharynx.

**Semicircular canals:** Structures in the inner ear involved in maintaining balance and spatial orientation.

**Sinuses:** Air-filled cavities in the skull connected to the nasal cavity, which help humidify and filter the air.

**Stapes:** The smallest bone in the human body, located in the middle ear, also known as the stirrup.

**Stratified squamous epithelium:** A type of tissue composed of multiple layers of flat cells, found in areas subject to abrasion such as the upper larynx.

**Tonsils:** Lymphoid tissues located at the back of the throat that help fight infections.

**Tympanic membrane:** The eardrum, a membrane that separates the outer ear from the middle ear and vibrates in response to sound waves.

**Uvula:** The small, fleshy extension at the back of the soft palate that hangs above the throat.

**Vestibular system:** The system in the inner ear involved in maintaining balance and spatial orientation.

**Vocal cords:** Bands of muscle in the larynx that vibrate to produce sound.

## MULTIPLE CHOICE QUESTIONS

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- Which part of the ear is responsible for balance?
  - Cochlea
  - Vestibular system
  - Tympanic membrane
  - Eustachian tube
- What is the smallest bone in the human body?
  - Malleus
  - Incus

- c) Stapes
  - d) Hyoid bone
3. What is the larynx commonly known as?
- a) Throat
  - b) Windpipe
  - c) Voice box
  - d) Eardrum
4. Which structure prevents food from entering the airway during swallowing?
- a) Uvula
  - b) Epiglottis
  - c) Tonsils
  - d) Nasal septum
5. The pharynx is divided into how many parts?
- a) Two
  - b) Three
  - c) Four
  - d) Five
6. Where is the nasopharynx located?
- a) Below the larynx
  - b) Behind the nasal cavity
  - c) Above the soft palate
  - d) Between the mouth and oesophagus
7. Which section of the ear is the cochlea a part of?
- a) Outer ear
  - b) Middle ear
  - c) Inner ear
  - d) Tympanic cavity
8. To what does the Eustachian tube connect the middle ear?
- a) Nasal cavity
  - b) Nasopharynx
  - c) Oropharynx
  - d) Hypopharynx
9. What is the function of the vocal cords?
- a) Filter air
  - b) Produce sound
  - c) Equalise ear pressure
  - d) Protect the trachea
10. What is the primary function of the nasal cavity?
- a) Produce mucus
  - b) Filter, warm and humidify air
  - c) Protect the pharynx
  - d) Support the olfactory bulbs

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