



Lecture 6

Respiratory System

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The Upper Respiratory Tract

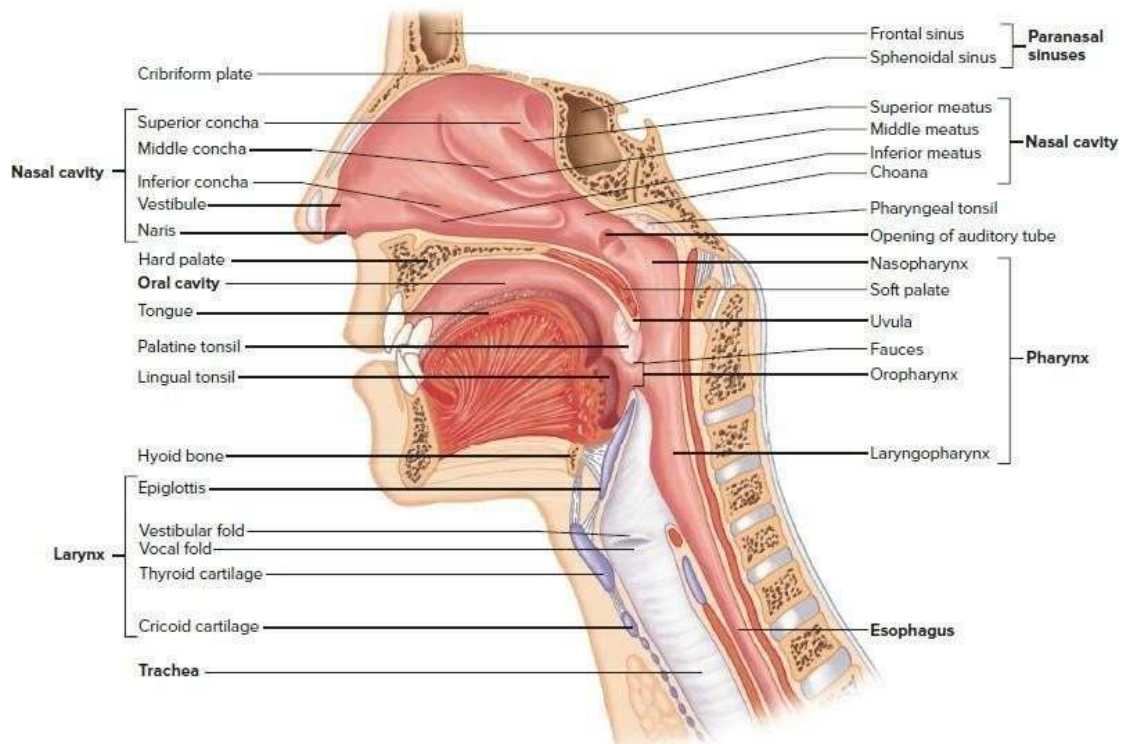
Nose and Nasal Cavity

The **nose** consists of the external nose and the nasal cavity.

The **external nose** is the visible structure that forms a prominent feature of the face. The largest part of the external nose is composed of hyaline cartilage plates. However, the bridge of the nose, which is where eyeglasses would rest, consists of bone.

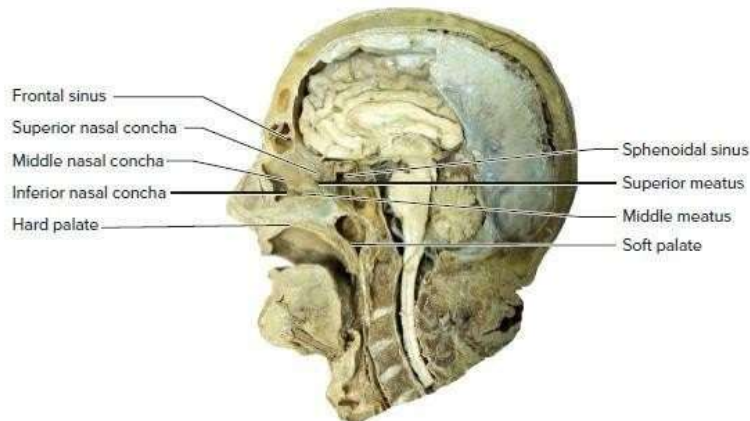
The **nasal cavity** is the open chamber inside the nose where air first enters the respiratory system. The nasal cavity begins at the anterior external openings called the **nares** or nostrils.

It extends to posterior openings into the pharynx. These openings are called **choanae** (KO-a-nay).



(a)

Medial view



(b)

Medial view

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The floor of the nasal cavity, which separates it from the oral cavity in the mouth, is called the **hard palate**. Within the nasal cavity, the hard palate is covered by a highly vascular mucous membrane. It is this mucous membrane that helps warm and humidify inspired air. The nasal cavity is divided into right and left halves. The two halves are separated by a wall of tissue called the **nasal septum**. The anterior part of the nasal septum is composed of cartilage, while the posterior part consists of bone. A deviated nasal septum occurs when

the septum bulges to one side and is a common cause of snoring.

On each side of the nasal cavity, there are three lateral bony ridges called **conchae**. The conchae used to be named the turbinate bones because they act as “wind turbines,” helping the air churn through the nasal cavity. In fact, people with chronic nasal congestion may have a turbinate reduction in which a surgeon performs a procedure to reduce the size of the nasal conchae. The air passes through tunnels beneath each concha. Within the superior and middle meatuses are openings from the various **paranasal sinuses**. The nasal cavity also contains the opening of a **nasolacrimal duct** for tear drainage from the surface of the eye.

Sinusitis is inflammation of the mucous membrane of a sinus, especially one or more of the paranasal sinuses. Viral infections, such as the common cold, can cause mucous membranes to become inflamed and swollen and to produce excess mucus. As a result, the sinus opening into the nasal cavity can be partially or completely blocked. In addition, mucus accumulation within the sinus can promote the development of a bacterial infection. The combination of buildup mucus and inflamed and infected mucous membranes produces pain. Treatment of sinusitis consists of taking antibiotics to kill the bacteria, taking decongestants to promote sinus drainage, drinking fluids to maintain hydration, and inhaling steam to keep nasal passages moist.

The nasal cavity has five functions:

Serves as a passageway for air. The nasal cavity .1 remains open even when the mouth is full of food.

Cleans the air. The nasal cavity is lined with hairs, .2 which trap some of the large particles of dust in the air.

Humidifies and warms the air. .3

Contains the olfactory epithelium. The olfactory epithelium, the sensory organ for smell, is in the most superior part of the nasal cavity. .4

Helps determine voice sound. The nasal cavity and paranasal sinuses are resonating chambers for speech. .5

For example, most people know immediately when you have a cold because your voice sounds different.

Pharynx

The **pharynx** or throat, is the common opening of both the digestive and the respiratory systems. The pharynx receives air from the nasal cavity and receives air, food, and drink from the oral cavity. Inferiorly, the pharynx is connected to the respiratory system at the larynx and to the digestive system at the esophagus. There are three regions of the pharynx: (1) the nasopharynx, (2) the oropharynx, and (3) the laryngopharynx.

The **nasopharynx** is the most superior portion of the pharynx. It is immediately posterior to the nasal cavity. Specifically, it is a continuation of the nasal cavity from the choanae. The nasopharynx is superior to the **soft palate**. The soft palate is an incomplete partition composed of muscle and connective tissue. It separates the nasopharynx from the middle portion of the pharynx, the oropharynx. The extension of the soft palate is called the **uvula**. The soft palate prevents swallowed materials from entering the nasopharynx and nasal cavity. The nasopharynx is continuous with the middle ear through the auditory tubes, openings on each side of the nasopharynx. Air passes through the auditory tubes to equalize air pressure between the atmosphere and the tympanic membrane. The posterior wall of the nasopharynx houses the **pharyngeal tonsil**, or adenoids, which helps

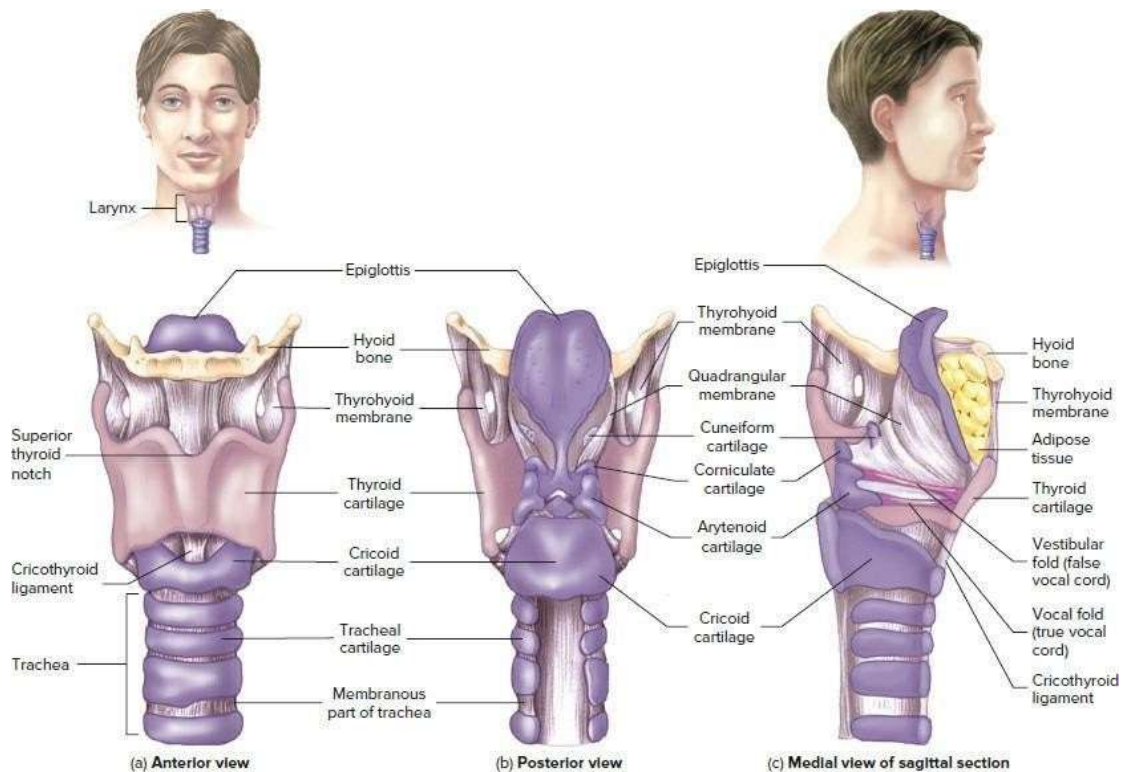
defend the body against infection. An enlarged pharyngeal tonsil can interfere with normal breathing and airflow through the auditory tubes.

The **oropharynx** is a continuation of the nasopharynx. The oropharynx is the middle portion of the pharynx. It is immediately posterior to the mouth and begins at the soft palate. From there, it descends to the superior portion of the larynx. Because the mouth's oral cavity and the oropharynx join, air, food, and drink all pass through the oropharynx. Moist stratified squamous epithelium lines the oropharynx and protects it against abrasion.

The **laryngopharynx** is a continuation of the oropharynx. Food and drink pass through the laryngopharynx to the esophagus. Although most air passes from the laryngopharynx into the larynx, a small amount of air may be swallowed with food and drink. The laryngopharynx is lined with moist stratified squamous epithelium.

Larynx

The **larynx** is commonly known as the voice box. It is in the anterior part of the laryngopharynx and extends from the base of the tongue to the trachea. The larynx is held in place by membranes and muscles superior to the hyoid bone. The rigid walls of the larynx maintain an open passageway between the pharynx and the trachea. Its rigidity is due to an outer casing of nine cartilages connected to one another by muscles and ligaments. Six of the nine cartilages are paired, and three are unpaired. The following is a list of the cartilages composing the larynx:



The larynx is called the voice box because it houses the ligaments used for speech as well as for swallowing and other functions. These ligaments include (1) the vestibular folds and (2) the vocal folds. The **vestibular folds**, or false vocal cords, are the superior pair of ligaments. The **vocal folds**, or true vocal cords, are the inferior ligaments. If the vocal folds become inflamed, **laryngitis** occurs, and the person “loses” his or her voice.

Figure 15.4 Vestibular and Vocal Folds

(the Far left) The arrow shows the direction of viewing the vestibular and vocal folds. (a) The relationship of

vestibular folds to the vocal folds and the laryngeal cartilages. (b) Superior view of the vestibular and vocal folds as seen through a laryngoscope. (b) CNRI/Science Source

The larynx, with its cartilages and the vestibular and vocal folds, perform four main functions:

1. Maintains an open passageway for air movements.

- Prevents swallowed materials from entering the larynx and lower respiratory tract. .2
- Produces sound for speech. .3
- Protects the lower respiratory tract from foreign materials. .4

Functions of the Vestibular and Vocal Folds

The vocal folds are the primary source of sound production. Air moving past the vocal folds causes them to vibrate and produce sound. The force of air moving past the vocal folds determines the loudness of the sound. The frequency of vibrations determines pitch, with higher frequency vibrations producing higher-pitched sounds and lower-frequency vibrations producing lower-pitched sounds. Skeletal muscles control the movement of the cartilages in the larynx, which changes the position and length of the vocal folds and thus the pitch of the sound. Because males usually have longer vocal folds than females, most males have lower-pitched voices. The sound produced by the vibrating vocal folds is modified by the tongue, lips, teeth, and other structures to form words.

In addition to sound production, the vestibular and vocal folds provide the most important method for preventing swallowed materials from entering the larynx. During swallowing, food passes over the epiglottis toward the esophagus and the vestibular and vocal folds move together medially, closing the glottis. The closure of the vestibular and vocal folds can also prevent the passage of air, as when a person holds his or her breath or increases air pressure within the lungs prior to coughing or sneezing.

