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HISTOLOGY OF THE UPPER RESPIRATORY SYSTEM

The respiratory tract is the pathway through which much needed oxygen enters the body. It begins at the nostrils of the nose, continuing into the nasal cavity. From here, it passes through the pharynx, larynx, trachea, bronchi, bronchioles and ends in the alveoli. The airway as a whole can be divided into two segments: a conducting segment (from the nostrils to the terminal bronchiole) and a respiratory segment (from the respiratory bronchioles to the alveoli).

The upper respiratory system, or upper respiratory tract, consists of the nose and nasal cavity, the pharynx, and the larynx. These structures allow us to breathe and speak. They warm and clean the air we inhale: mucous membranes lining upper respiratory structures trap some foreign particles, including smoke and other pollutants, before the air travels down to the lungs.

Nasal cavity

The nose, as the primary mode of entry of air into the airway, has both respiratory and olfactory functions. In its respiratory capacity, it modifies the air so that gaseous exchange will occur more efficiently in the lungs, while in its olfactory capacity, it detects various odors and transmits those impulses to the brain for interpretation.

Entering the nares, or nostrils, the nasal vestibule is lined by keratinized stratified squamous epithelium – a continuation of the cutaneous lining from the external nose. It is also equipped with modified hairs, called vibrissae that filter out larger particles from inspired air. The membrane transitions from keratinized stratified squamous epithelium to pseudostratified columnar ciliated epithelium with goblet cells (also called respiratory epithelium) at a point known as the limen nasi.

The respiratory epithelium covers the floor, medial and lateral walls (just below the superior concha) of the nasal cavity to the choana (posterior boundary of the nasal cavity). Additionally, there are seromucous glands dispersed throughout the mucous membranes. Their secretions aid in respiration by moistening the inspired air and trapping unwanted particles. The trapped particles are propelled by the cilia to the pharynx where they can be expelled orally, or swallowed and digested.

The roof of the nasal cavity in the region of the cribriform plate of the ethmoid bone, the superior concha and the superior aspect of the nasal septum (composed of the perpendicular plate of the ethmoid bone) are covered with pseudostratified columnar epithelium without goblet cells and motile ciliae (olfactory epithelium).

Olfactory mucosa lines the roof and portions of the walls of the nasal cavity. It

contains several cell types: basal cells, brush cells, olfactory cells and sustentacular cells. Basal cells are located in the basal lamina. Brush cells are involved with general sensation of the olfactory mucosa. Olfactory cells are bipolar neurons that are the receptors for smell. Sustentacular cells are supporting cells. Sustentacular cells are most numerous cell type in the olfactory epithelium.

PHARYNX

The epithelia of the pharyngeal portion of the conducting zone changes with respect to each pharyngeal segment. In the nasopharynx, the epithelium is continuous with that of the nasal cavity. The ciliae here continues to wharf foreign particles through the pharynx to be swallowed.

In the oropharynx and laryngopharynx, the epithelium transitions to non-keratinized stratified squamous epithelium. This durable epithelium is better suited to accommodate friction associated with swallowing food. Additionally, lymphatic aggregates (distributed throughout the mucosa) act as a first contact point for the immune system to sort through particles entering the body.

The pharynx is lined by both stratified squamous epithelium and ciliated pseudostratified epithelium with goblet cells. Different regions are lined by a different type of epithelium. Regions of the pharynx that are likely to be roughened up by food are lined by stratified squamous epithelium. Other regions of the pharynx are lined by ciliated pseudostratified epithelium with goblet cells. The vestibule is lined by stratified squamous epithelium.

LARYNX

The larynx is a complex tubular segment of the respiratory system formed by irregularly shaped plates of hyaline and elastic cartilage. The mucosa form two pairs of folds, false and true vocal cords, which extend into the lumen of the larynx. The laryngeal epithelium corresponding to the mechanically exposed areas consists of stratified squamous nonkeratinized epithelium. Suprabasally in this epithelium, dendritic antigen-presenting Langerhans cells (LCs) can be found. In the rest of the larynx, the epithelium is ciliated columnar pseudostratified with a rich population of goblet cells. Except in the true vocal cords, lamina propria consists of rather loose connective tissue and contains groups of small, branched tubuloalveolar glands.

.The larynx is composed of several cartilages. The thyroid cartilage, cricoid cartilage, arytenoid cartilages, corniculate cartilages and cuneiform cartilages are all composed of hyaline cartilage. The epiglottis is elastic cartilage. There is no fibrocartilage in the larynx.