Objectives:

By the end of this lecture the student should be able to describe the microscopic structures of:

- **Vestibule of the nasal cavity.**
- **Respiratory mucosa of the nasal cavity.**
- **Nasal septum.**
- **Olfactory mucosa of the nasal cavity.**
- **Mucosa of the paranasal sinuses.**
- **Larynx.**

General Note:
Respiration means gas exchange which is the main function of respiratory system that occurs in alveoli.

Upper Respiratory Tract	Lower Respiratory Tract
Nasal cavity	**Trachea**
Paranasal sinuses	**Bronchi**
Larynx	**Bronchioles**
This will be discussed in this lecture	**Lungs**

RESPIRATORY SYSTEM

Conducting portion:

1- <u>Nasal cavity</u>.

2- Nasopharynx.

3- <u>Larynx</u>.

4- Trachea.

5- Primary bronchi (extrapulmonary bronchi).

6- Intrapulmonary bronchi:

- 2ry bronchi (lobar bronchi).
- 3ry bronchi (segmental bronchi).

7- Primary bronchioles (preterminal bronchioles).

8- Terminal bronchioles

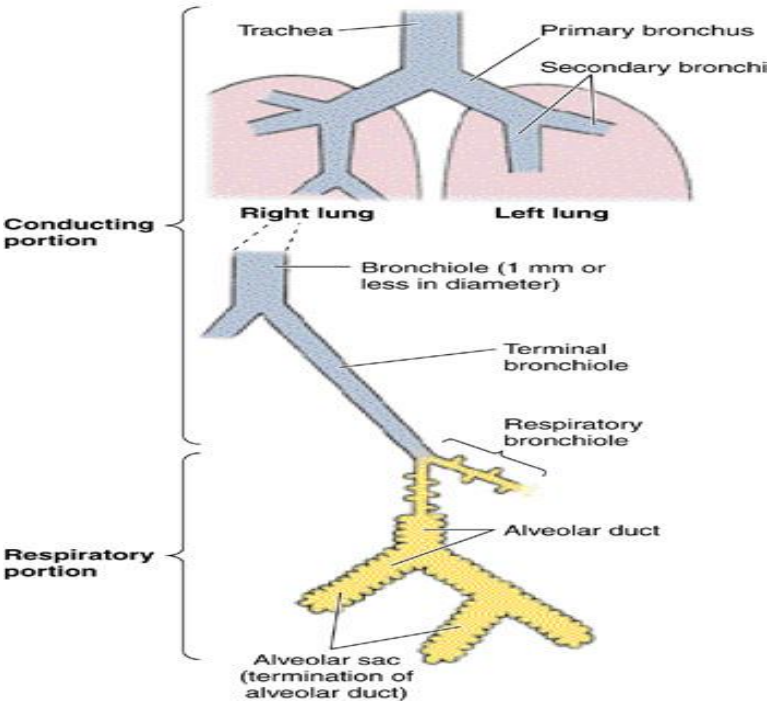
Respiratory portion:

1- Respiratory bronchioles

2- Alveolar ducts

3- Alveolar sacs

4- Pulmonary alveoli



1- NASAL CAVITY (N.C.)

(1) Anterior portion of N.C.:
Vestibule.

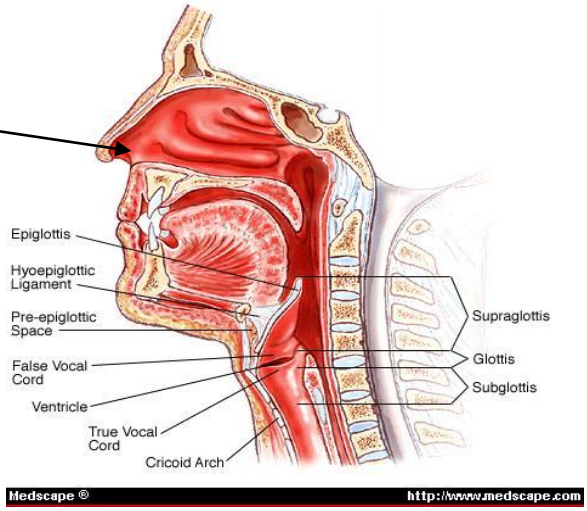
(2) Posterior portion of N.C.:

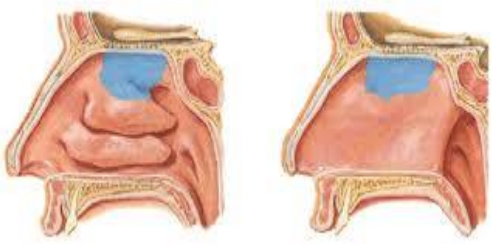
a- **Respiratory region.**

b- **Olfactory region.**

- ✓ Olfactory region: For smelling. It is in the upper part of nasal septum
- ✓ There are 2 mucus membranes in posterior portion of N.C: (respiratory mucosa & olfactory mucosa).

N.B. The nasal septum divides the nasal cavity into two halves (right and left).





ANTERIOR PORTION: VESTIBULE OF N.C.

Lining: is lined with thin skin.

1- Epidermis: (Keratinized stratified Squamous epithelium).

2- Dermis.

- ✓ There is no mucus membrane in anterior portion of N.C because it's a continuation of the face skin hence the contents will be skin contents.

Contents:

1- **Vibrissae**: stiff hairs.

2- Sebaceous glands. (Always it is more number in face and scalp)

3- Sweat glands.

Wall:

1- Hyaline cartilage. 2- Cancellous (spongy) bone.

2-PARANASAL SINUSES

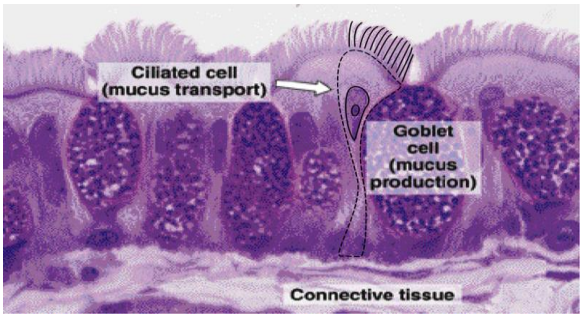
Lining: 1- Respiratory epithelium. (Pseudo-stratified ciliated columnar epithelium with goblet cells)

2- Lamina propria.

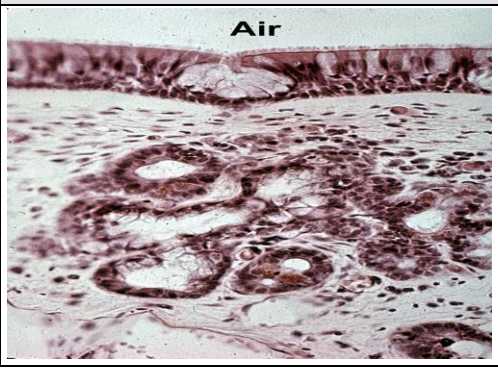
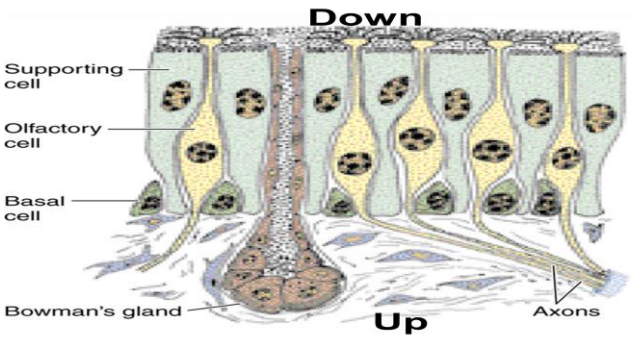
CLINICAL APPLICATION:

Sinusitis.

- ✓ Paranasal sinuses open (drain) into nasal cavity, but if there is occlusion the mucus secretions will accumulate and the bacteria in the air inside the paranasal sinuses will lead to infection causing sinusitis.



http://www.youtube.com/watch?v=SPtJnv-a7do
This video is helpful for histology, anatomy and pathology

POSTERIOR PORTION	Respiratory Region (Area) Of N.C	Olfactory Region (Area) Of Nasal Cavity
Mucosa (Mucous membrane)	A) Epithelium: Pseudo-stratified ciliated columnar epithelium with *goblet cells* (Respiratory epithelium). ✓ It is avascular so there is C.T beneath it.	A) Olfactory epithelium: Pseudo-stratified columnar epithelium. 1- **Olfactory cells** (olfactory nerve cells) 2- **Sustentacular**(supporting) **cells.** 3- **Basal cells:** Pyramidal in shape, basal in position and act as stem cells.
	B) Lamina propria(Sub-epithelial loose C.T.): 1- Large arterial plexuses & venous sinuses (Highly vascularized C.T. to warm air thus bleeds fast.) 2- Many **seromucous** glands (acini). ✓ When we have flu → the secretion is watery (serous) but in normal conditions is viscous (mucus). 3- Abundant lymphoid elements(immune cells) : Including occasional lymphoid nodules,plasma cells & mast cells.	B) Lamina propria:contains: 1- Highly (richly) vascularized loose to dense C.T. 2- Contents: a) Bowman's glands (olfactory glands) : are **serous**acini (watery which is the best solvent to dissolve chemical particles that we smell). b) Bundles of unmyelinated nerve fibers: Are axons of olfactory nerve cells + Schwann-like cells (glial cells). c) Rich vascular plexus. d) Numerous lymphoid elements.
Site	Lower part of nasal septum.	1-Roof of nasal cavity. 2-Upper part of nasal septum. 3-Over superior concha.
L\M		

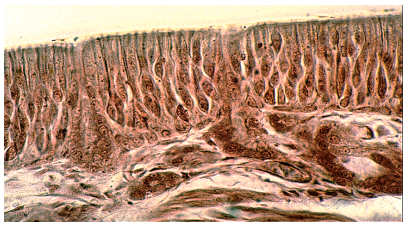
OLFACTORY EPITHELIUM

1- Olfactory cells(most important cell**):**Are **bipolar neurons**(bipolar meaning they have two long processes). **Dendrite** has olfactory vesicle (dilated end) that has nonmotile cilia. **Axons** are unmyelinated with Schwann-like cells. Axons will collect in the lamina propria to form bundles of nerve fibers. Bundles will collect to form the olfactory nerve.

- ✓ Olfactory mucosa has yellow color because there are neuronal cells that have lipofuscin pigments. They are the only neuronal cells that can renew (each year) because there are basal cells (stem cells) that are found in that area.

2- Sustentacular (supporting) cells: Are columnar cells.

Function: Physical support and nourishment for olfactory cells.



Notes:

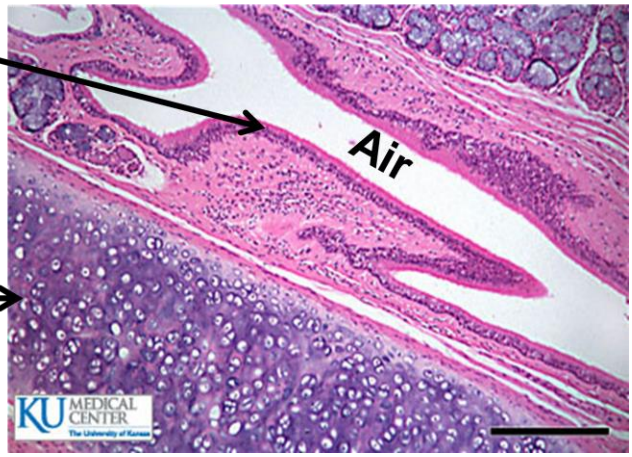
1. C.T underlying epithelial cells in wet area is called Lamina propria& it's rich in blood vessels to warm the incoming air & highly vascularized so it bleeds fast.
2. Lamina propria is C.T underneath epithelial tissue to supply it since epithelial tissue is avascular.
3. Epithelium with Lamina propria (C.T), when found in wet areas, are called mucosa (mucous membrane).
4. Wetness in the nose is caused by: (1) Goblet cells (2) Seromucous glands
   It must always be wet because this wetness helps in trapping dust & foreign bodies **(in respiratory region of N.C)**

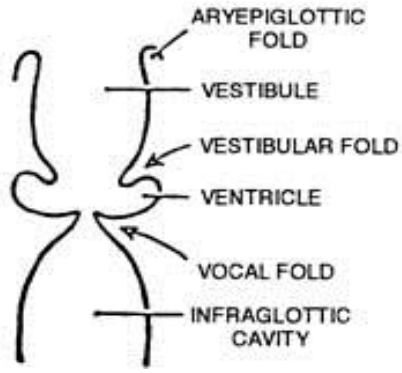
Components	3- Larynx
1- Mucosa	1- Epithelium: (2 types) a- Respiratory epithelium: Pseudostratified ciliated columnar epithelium with goblet cells. b- Non keratinized stratified squamous epithelium: In: - Vocal folds. - Superior (anterior) surface of epiglottis. ✓ However, the other surface that is exposed to larynx is covered with respiratory epithelium. ✓ Epiglottis is like a posterior continuation oftongue.
	2- Lamina propria.
	3-There are 2 pairs of shelf-like mucosal folds: 1- **Vestibular folds** : Are immovable. ✓ When food particles enter the respiratory tract ⟶ they are stopped by the vestibular fold but sometimes reach trachea & this may lead to suffocation hence death. L/M: a- *Respiratory* epithelium. b- Lamina propria: Loose C.T. with seromucous glands lymphoid elements & adipose cells. .. 2- **vocal folds (cords):**have: a- Epithelium:*non keratinized stratified squamous.*(to protections from the friction when we speak) b- Lamina propria: C.T. containing bundles of elastic fibers and skeletal muscle . N.B. No lymphoid nodules, No seromucous glands. Because they should be as thin as possible to make the movement easier.
2- Cartilages	**1- Hyaline cartilages:e.g.** Thyroid cartilage. **2- Elastic cartilages:**Epiglottis.
3- Extrinsic & intrinsic muscles	all are skeletal(because talking is under person's control.)
4- Ligaments	

Note (extra info): Epiglottis has 2 surfaces: when it is erected we call the surfaces: 1) anterior. 2) Posterior.BUT When it closes the larynx: 1) Dorsal. 2) Ventral. (either this or that both are correct just regarding the position).

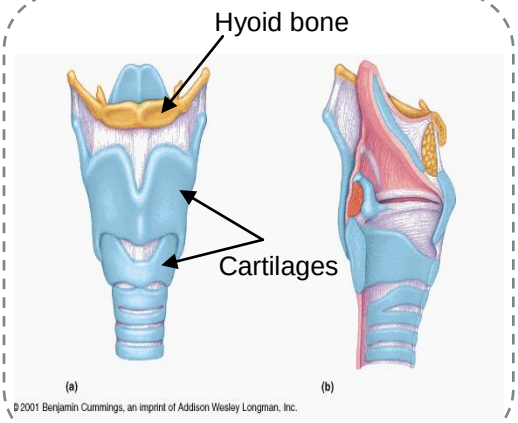
Respiratory epithelium

It's most likely epiglottis because there is elastic cartilage





The shelf-like folds



RESPIRATORY EPITHELIUM

Pseudo-stratified ciliated columnar epithelium with goblet cells.

Main Types of cells (all touch the basement membrane)

1- <u>Ciliated columnar cells.</u>

2- <u>Goblet cells.</u>

3- Basal cells: are stem cells.

✓ Respiratory epithelium of larynx can easily degenerate so there are basal cells to regenerate goblet cells & ciliated columnar cells.

4- DNES cells: e.g. serotonin.

✓ Diffuse Neuro-Endocrine System Cells (DNES cells) don't form special gland; they are scattered.

Please send us any questions or mistakes on 432histologyteam@gmail.com