



Functional organization of the respiratory system

OBJECTIVES

- Describe the structures and functions of the conductive and respiratory zones of airways
- Understand the difference between internal and external respiration.
- Understand the functions of the respiratory system, including non-respiratory functions and its physiological significance

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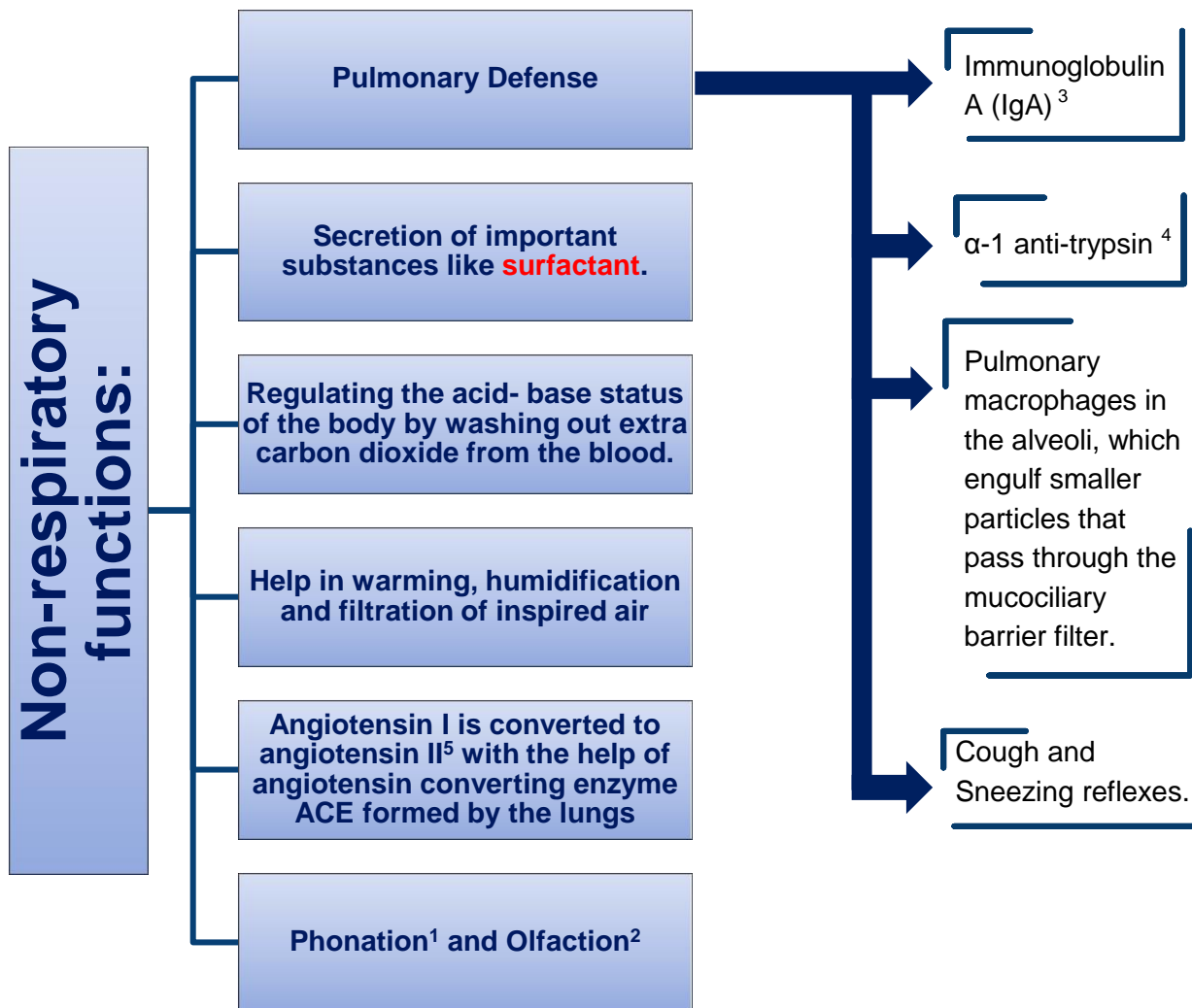
COLOR INDEX:

- Red = important
- Grey = additional notes

1- FUNCTIONS OF THE RESPIRATORY SYSTEM.

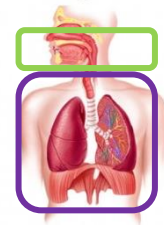
Main goal of respiration: Gas exchange "Providing O₂ to tissues + removing CO₂"

(Respiratory function) .



- 1- The production of sounds by the movement of air through the vocal cords
- 2- Smell sensation , Through the olfactory receptors it Contains
- 3- Most common of the primary Antibodies that protects against infections of membrane lining
- 4- Trypsin is a proteolytic enzyme produced by bacteria and inflammatory cells, α-1 anti-trypsin is a serum inhibitor
- 5- Angiotensin is an oligo peptide that causes vasoconstriction and high BP.

Respiratory system Diagram



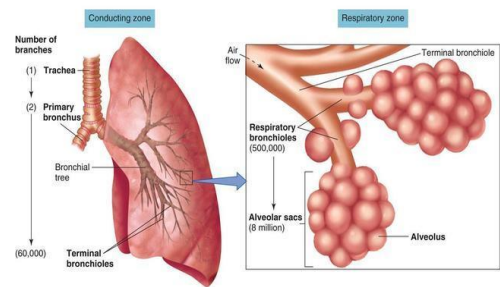
2- WHAT MAKES THE RESPIRATORY SYSTEM? :

Respiratory system consists of:

- Respiratory centers "RC"
- Respiratory muscles
- Respiratory passage (airway) including upper¹ and lower²

Respiratory tract can be divided into:

	1-Conducting Zone	2-Respiratory unit or zone " acinus"
Include	Starts from nose to the end of terminal bronchioles. (Trachea, Main bronchi "1 st , 2 nd and 3 rd ", preterminal Bronchiole, terminal bronchiole)	Respiratory bronchioles, alveolar ducts, alveolar sacs, alveoli
Function	non-respiratory functions "to filter, warm, and moisten air"	Respiratory function "Gas exchange"



3- RESPIRATORY PROCESS AND TYPES OF RESPIRATION

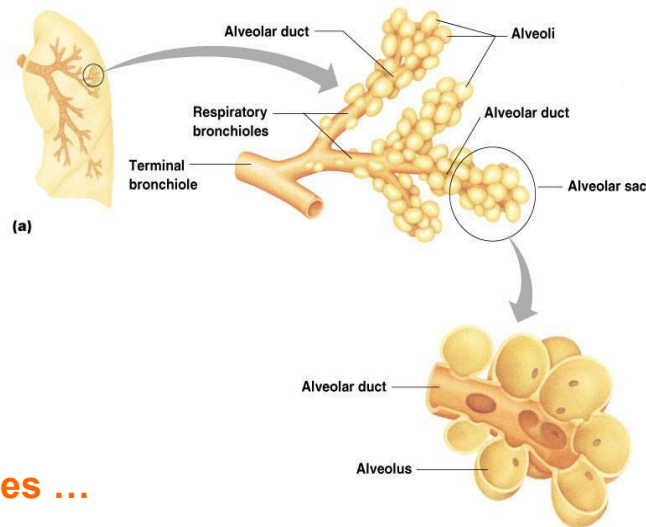


Remember: Breathing = ventilation = Air in to and out of lungs!

And Respiration could be either

- Resting : normal breathing during resting conditions
- Forced (maximal): during exercise, in patients with asthma, allergy...etc

1- Upper respiratory tract : Nose + Pharynx and associated structures
2- Lower respiratory tract : Larynx + Trachea + Bronchi + Lungs

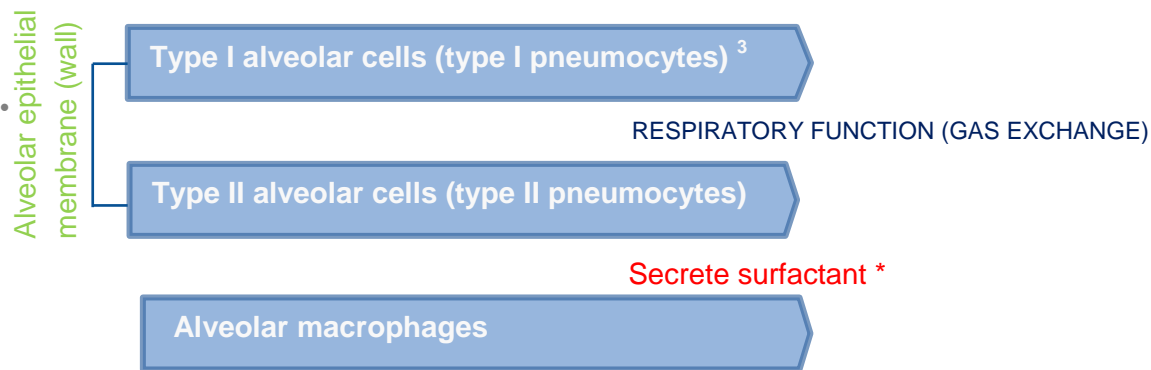


And it's of 2 types ...

1- Internal respiration ¹	2- External respiration ²
<p>A metabolic process during which oxygen is released to tissues and carbon dioxide is absorbed by the blood.</p> <p>“one Major functional event occurring during it is the <u>Transport</u> of O₂ & CO₂ in the blood and body fluids to and from the cells”</p>	<p>2 major functional events occur during it:</p> <p>1- <u>Pulmonary ventilation</u>: inward and outward movement of air between lung and atmosphere.</p> <p>2- <u>Diffusion</u> of oxygen and CO₂ between the alveoli and the pulmonary capillary blood</p>

N.B: Internal respiration is very different from cellular respiration, the last refers to the Biochemical pathway by which cells release energy from food molecules and provide that energy for essential processes of life (Oxygen use to produce ATP, carbon dioxide as waste).

4-LINING CELLS OF THE ALVEOLI:



** Respiratory membrane (Blood-Air Barrier)⁴:



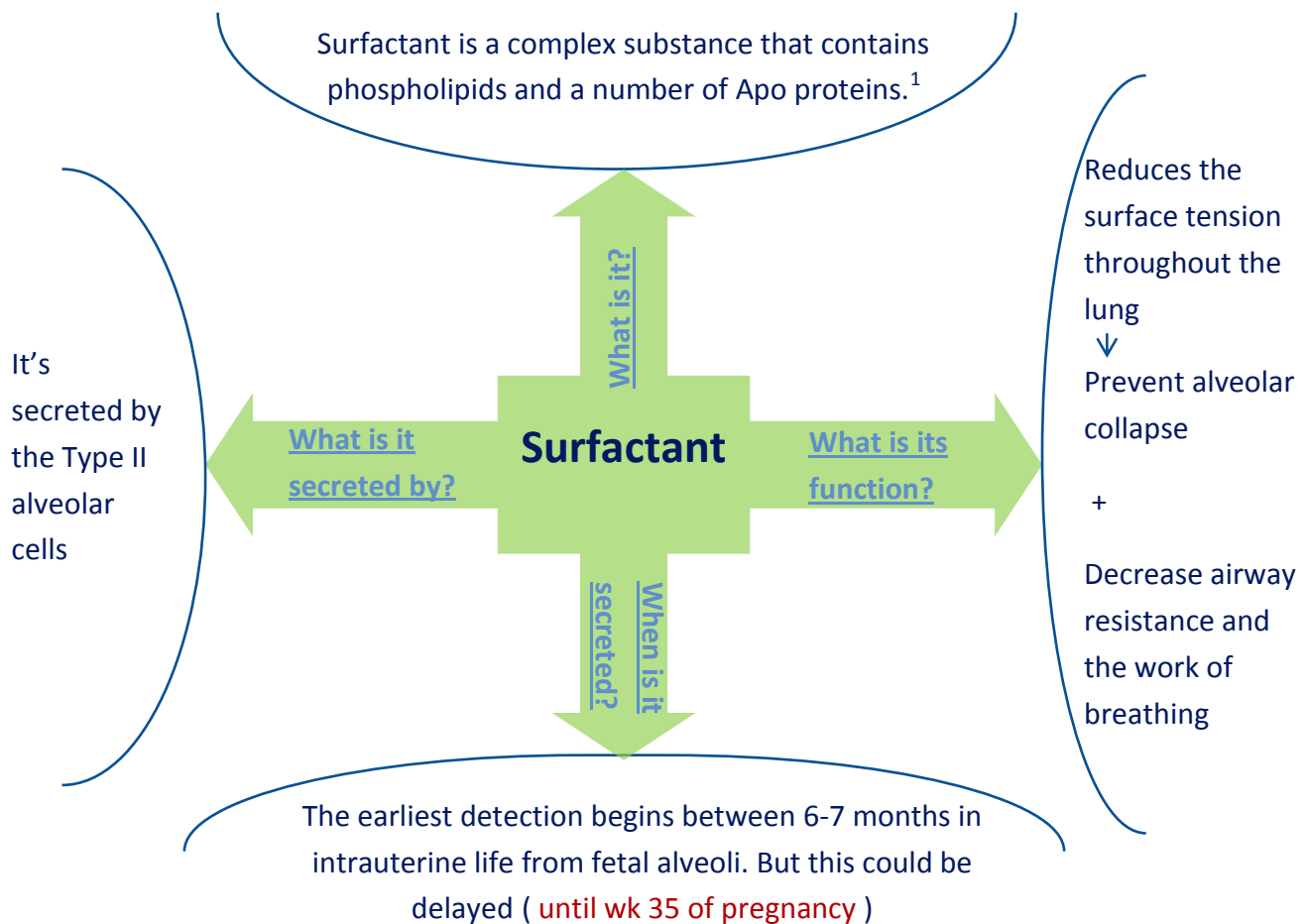
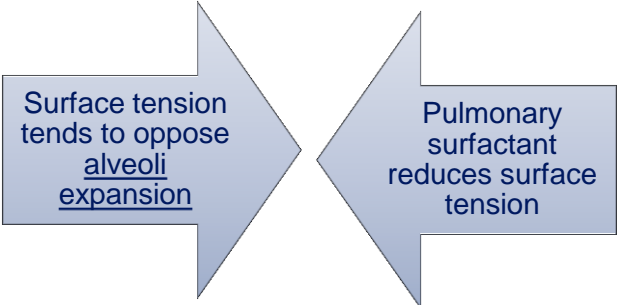
- 1- Gas exchange between blood and body cells /tissues
- 2- Gas exchange between lungs and blood
- 3- Simple squamous
- 4- The respiratory membrane is where the gas exchange occur

The walls of the alveoli are coated with a thin film of water & this creates a potential problem. Water molecules, including those on the alveolar walls, are more attracted to each other than to air, and this attraction creates a force called **surface tension** !

So we can define surface tension as ...

Attraction of water molecules to each other by attractive forces that tend to resist distention

Surface tension increases as water molecules come closer together, which is what happens when we exhale & our alveoli become smaller. Potentially, surface tension could cause alveoli to collapse and, in addition, would make it more difficult to 're-expand' the alveoli (when you inhale). Both of these would represent serious problems, Fortunately, our alveoli do not collapse & inhalation is relatively easy because the lungs produce a substance called surfactant that reduces surface tension..



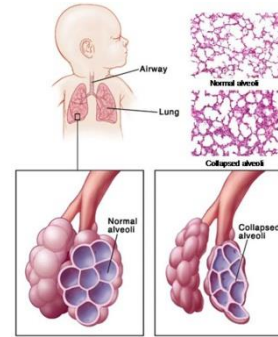
1- Apo proteins are conjugated proteins from which the prosthetic group has been removed for example : apohaemoglobin is haemoglobin without its haem group

Insufficient amount of surfactant can be found in both adults and infants BUT they're caused by different factors

➤ **In premature babies**

Respiratory distress syndrome of the newborn (RDS) or (Hyaline membrane disease)¹

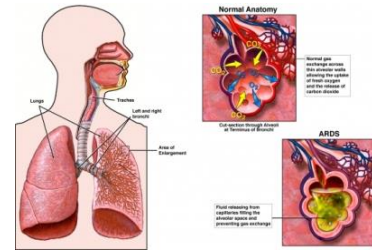
Cause: occurs in infants whose lungs have not yet fully developed it is mainly caused by lack of surfactant



➤ **In adults**

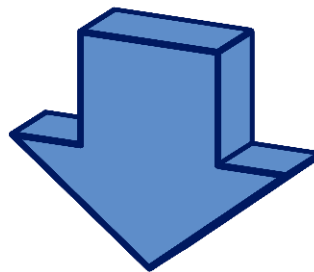
Adult respiratory distress syndrome (ARDS).

Cause: Smoking, hypoxia (low oxygen in tissues) or hypoxemia (low oxygen in the arterial blood) or both, decreases in the secretion of surfactant



5-INNERVATIONS OF LUNGS AND BRONCHI

It is mainly innervated by **autonomic nerves ANS.**

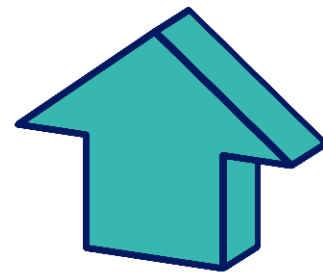


The Parasympathetic nervous system: causes **constriction** of the bronchi.

In addition to locally secreted factors:

- histamine
- slow reacting substances of anaphylaxis (SRSA)² secreted by mast cells due to allergy (as in patients with asthma) often cause bronchiolar constriction and increase airway resistance.

The Sympathetic nervous system causes: **dilatation** of the bronchi

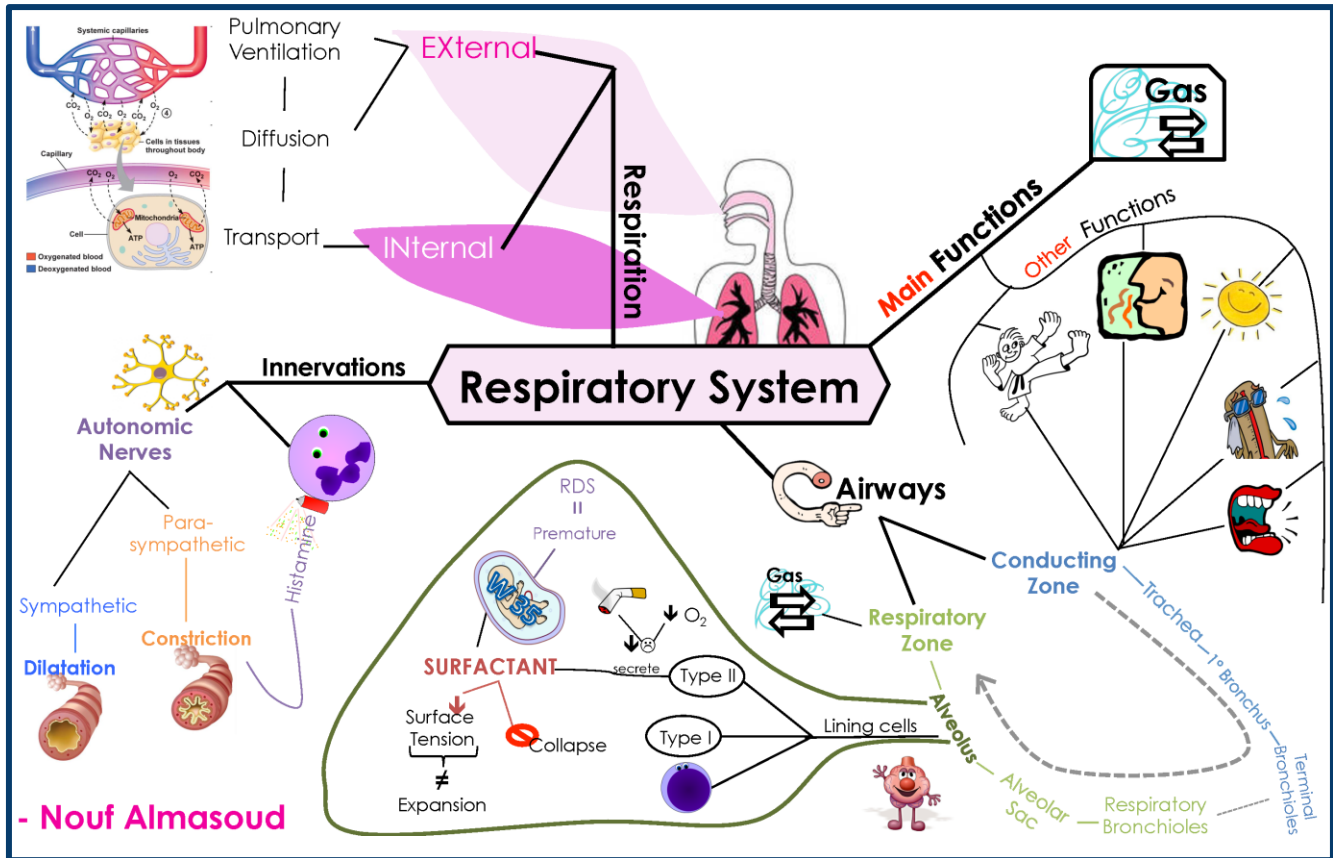


1- It's a condition in newborn babies in which the lungs are deficient in surfactant preventing their proper expansion and causing formation of hyaline material in the lung spaces
 2- Active in the presence of antihistamines.

Check your understanding



The video is a bit long but it gives you a great Overview and helps in coming lectures ..



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