



RESPIRATO RY SYSTEM

Chapter 16



PRIMARY FUNCTIONS

- Exchange gases (oxygen and CO₂)
- Produce vocal sounds
- Sense of smell
- Regulation of blood PH



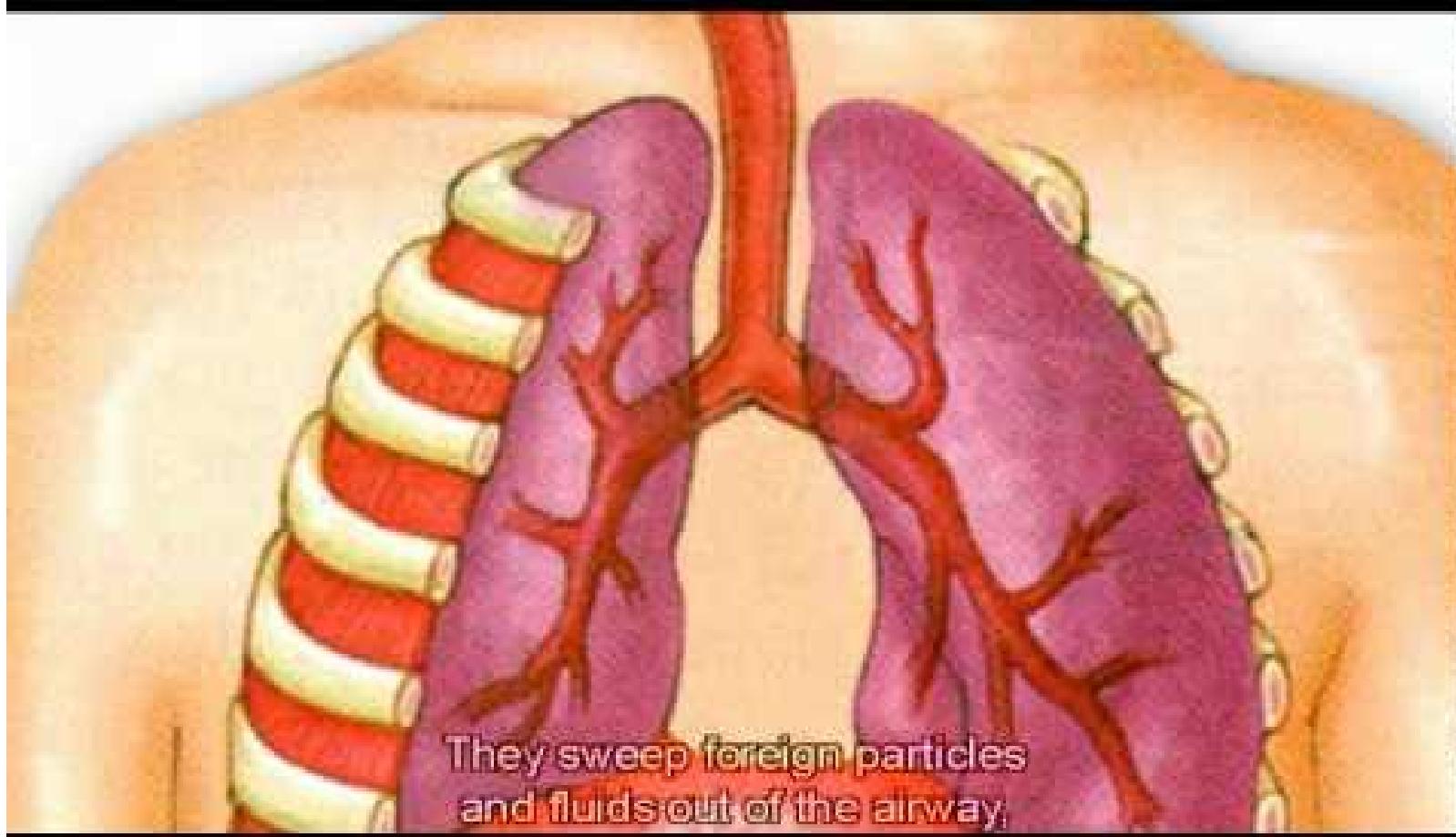
LUNG CAKE



Respiration - process of gas exchange

1. Movement of air into lungs
2. Gas exchange between blood and air
(external respiration)
3. Gas transport in blood
4. Gas exchange between blood and body cells
(internal respiration)

*Cellular Respiration - oxygen use and CO₂ production at a cellular level



They sweep foreign particles
and fluids out of the airway,

Organs of the Respiratory System

Main organs of the upper and lower respiratory system

Conducting Passages

Upper respiratory tract

Nasal cavity

Pharynx

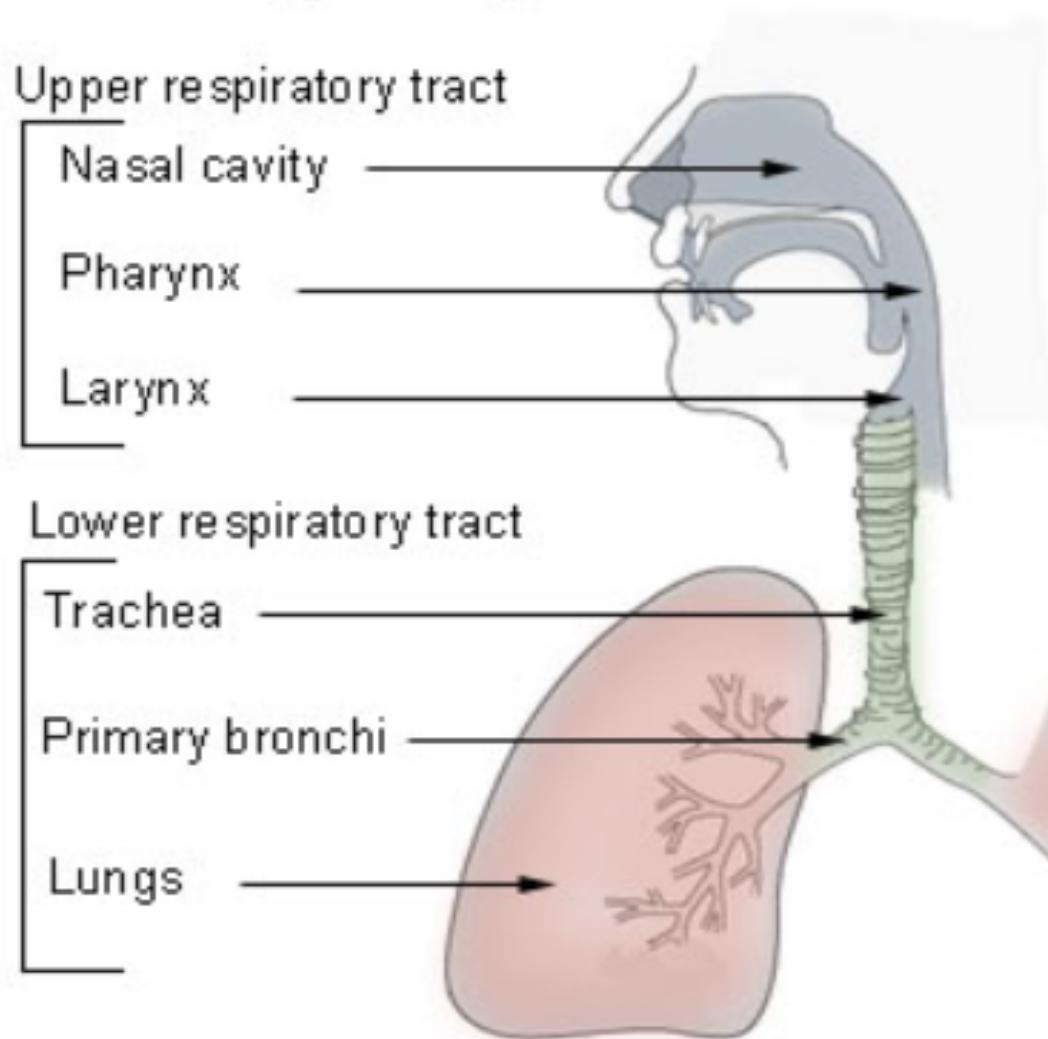
Larynx

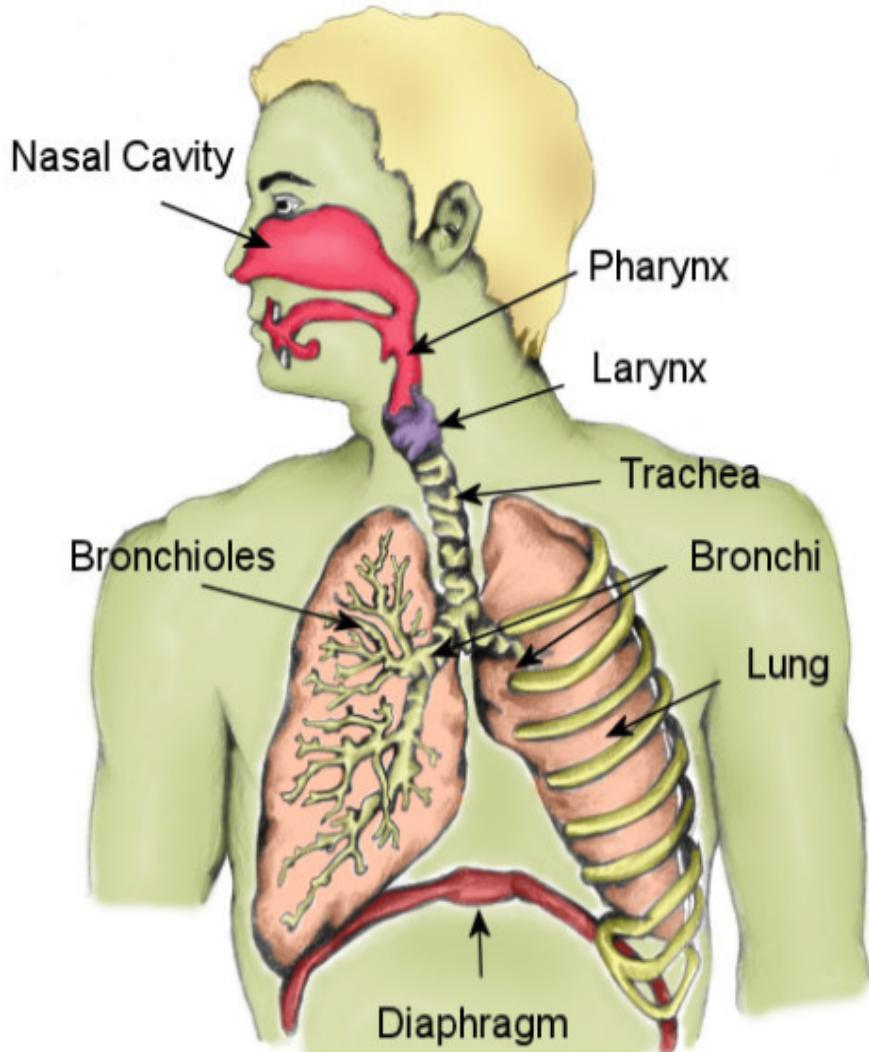
Lower respiratory tract

Trachea

Primary bronchi

Lungs





Upper Respiratory Tract – nose, nasal cavity, paranasal sinuses, pharynx

Lower Respiratory Tract – larynx, trachea, bronchial tree, lungs

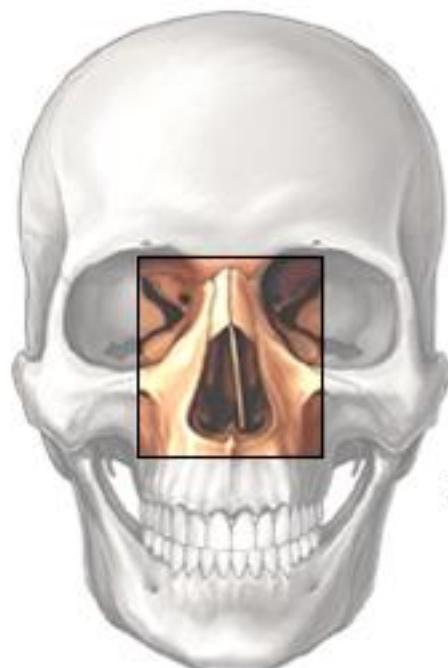
The NOSE bones and cartilage support nose, two openings (nostrils), hair filters large particles

Nasal Cavity –
hollow space
behind the nose
Nasal septum –
divides the nose
(bone)

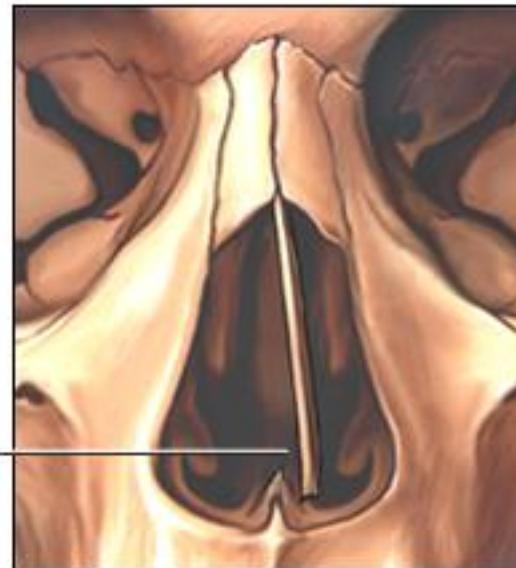


Nasal conchae – bones that divide the nasal cavity, support the mucus membrane and increase surface area (superior, middle, inferior)

* deviated septum – when the septum bends to one side



Deviated
nasal
septum

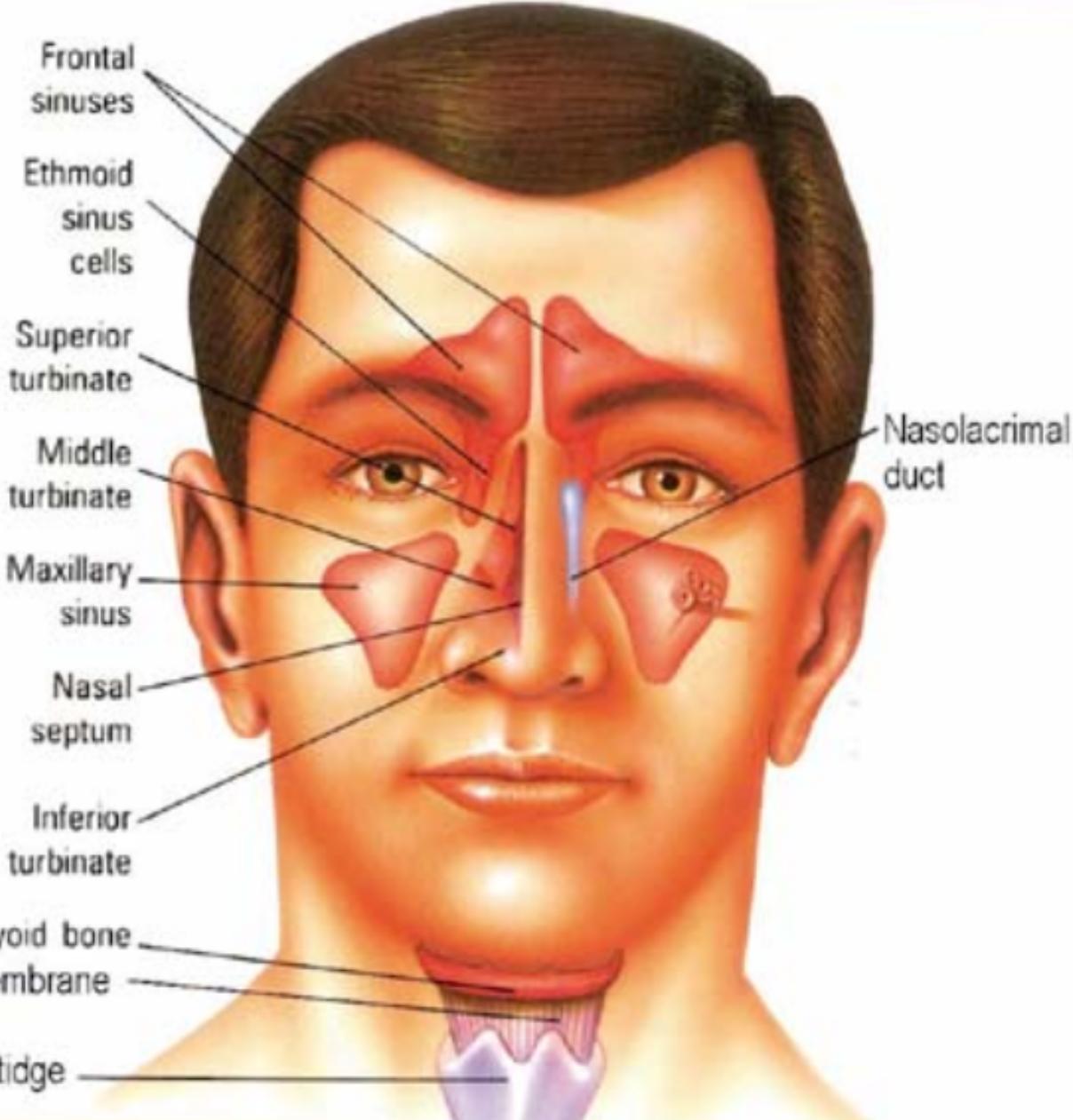


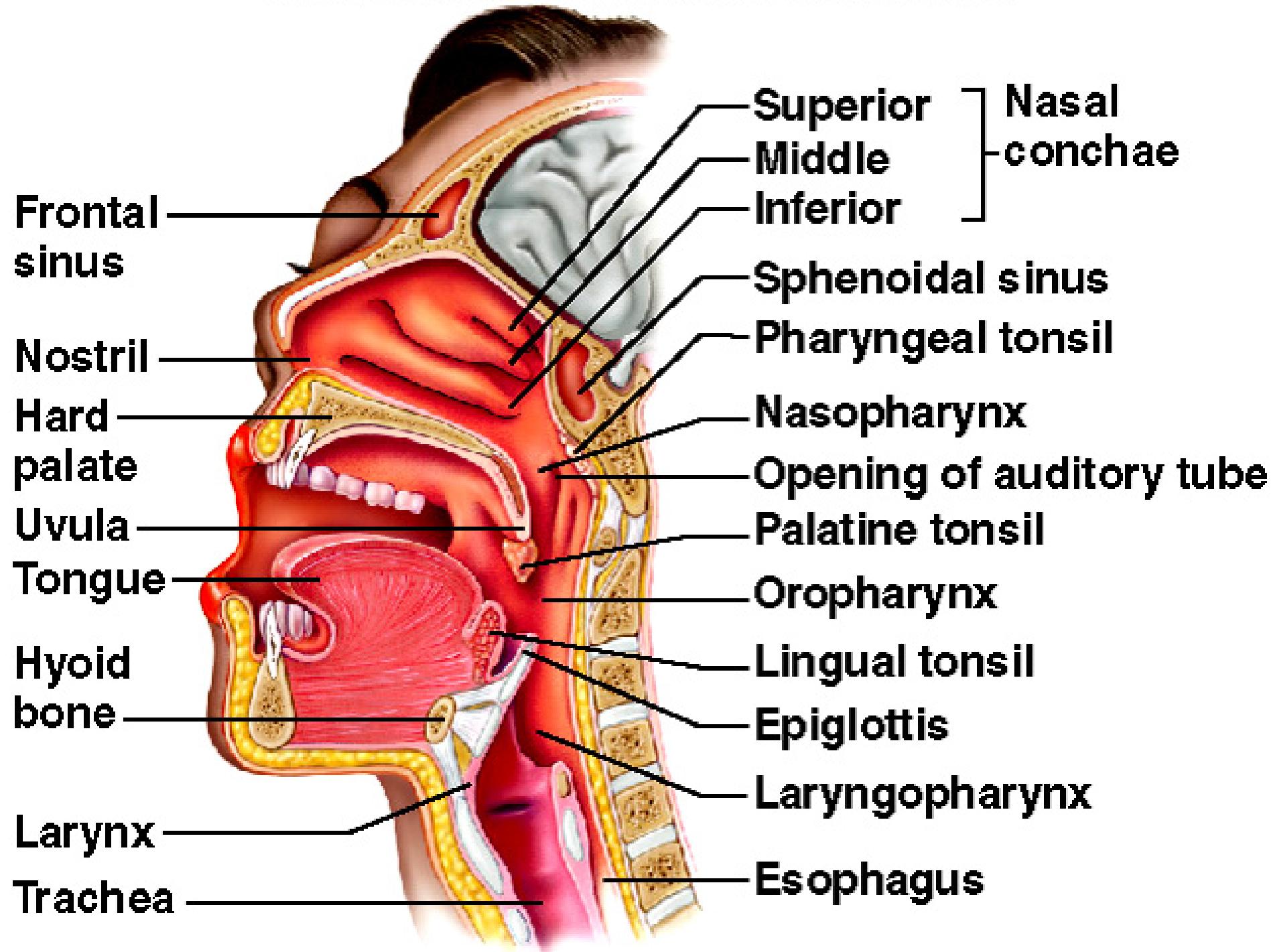
Paranasal Sinuses -

– spaces within
the bones

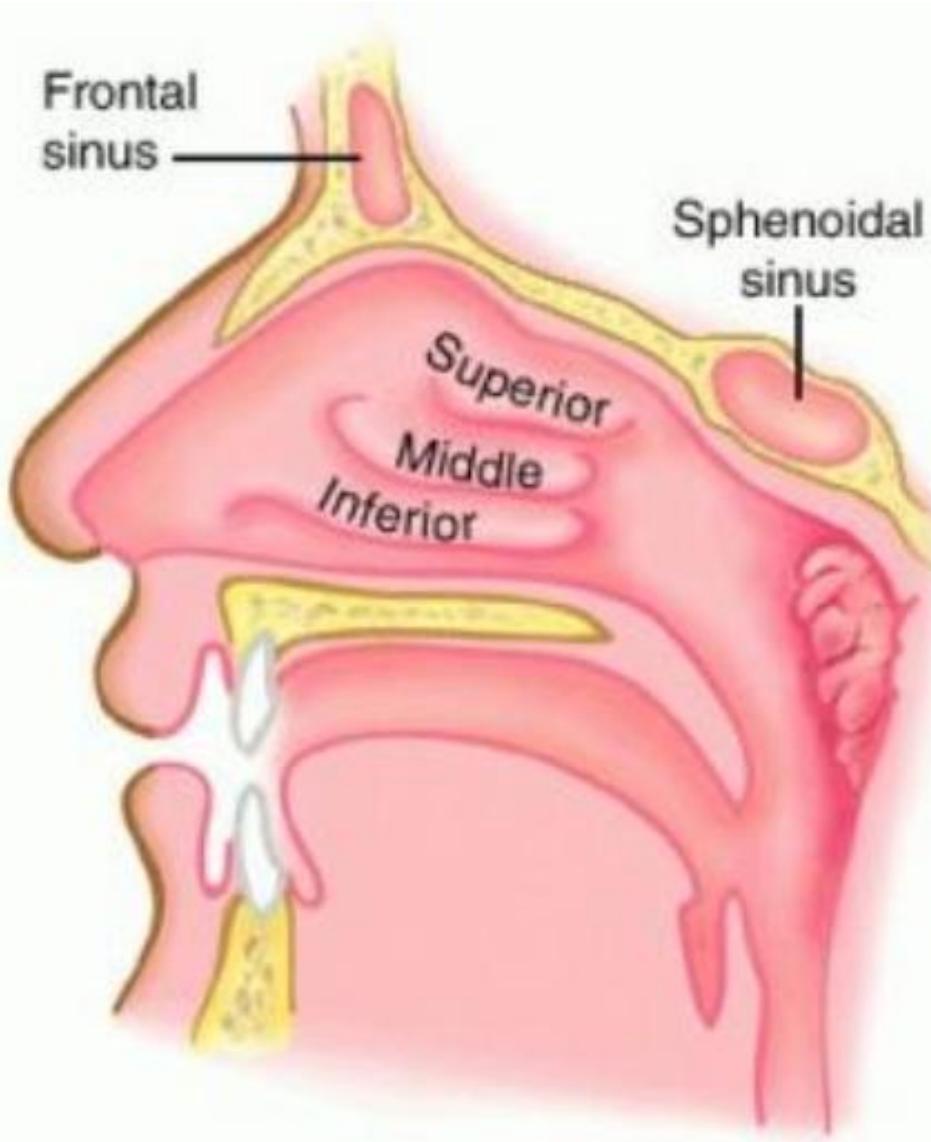
- maxillary
- frontal
- ethmoid
- sphenoid

reduce the weight of
skull and are resonant
chambers for voice.





Nasal Conchae

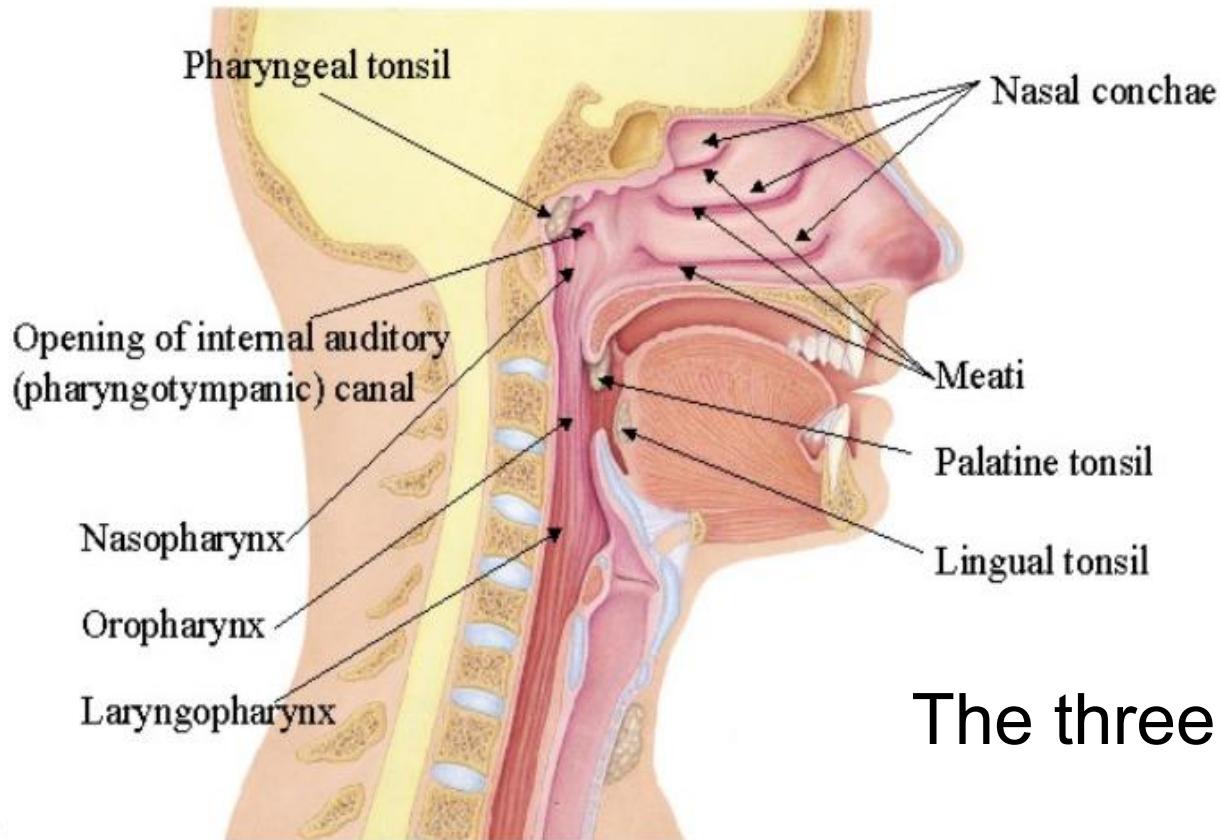


Function of the conchae - increase surface area

Mucus Membrane - warms and moistens air, also traps particles (dust)

*particles go to stomach

The Upper Division



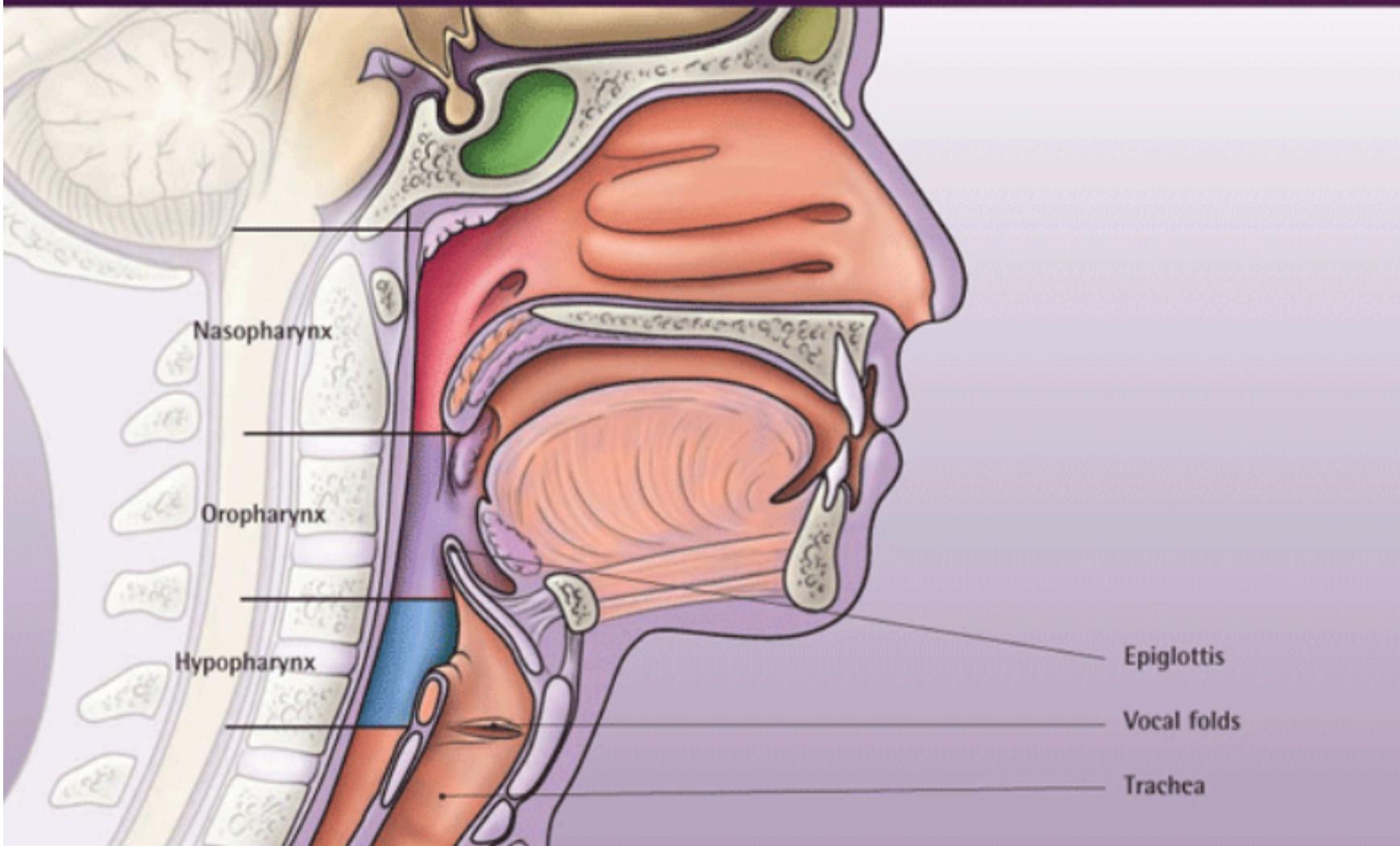
(b)

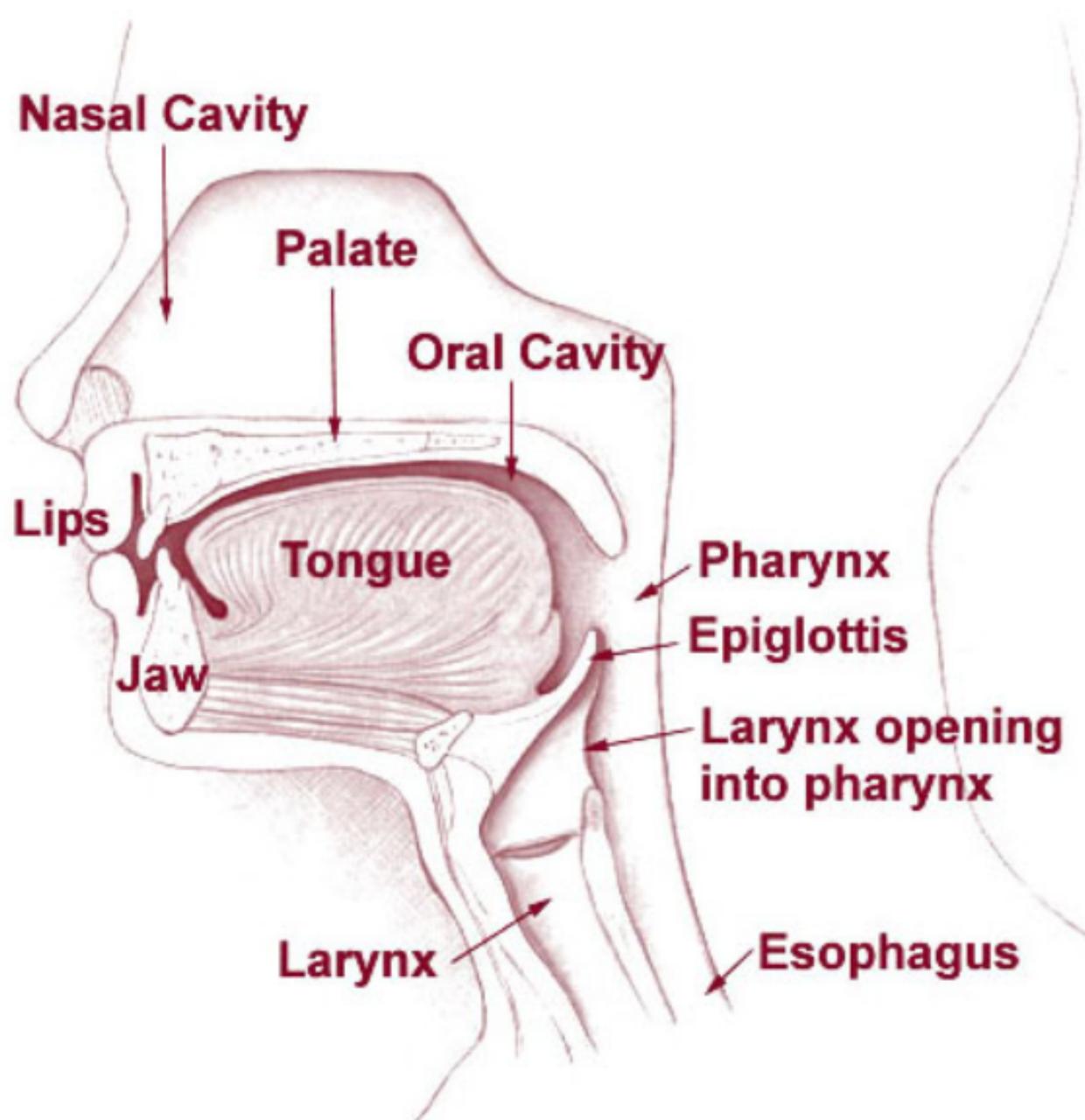
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The three pharyngeal regions

Pharynx – behind the oral cavity, between the nasal cavity and larynx (space, not a structure)

Pharynx





Frontal sinus

Nasal cavity

Hard palate

Nostril

Oral cavity

Larynx

Bronchus

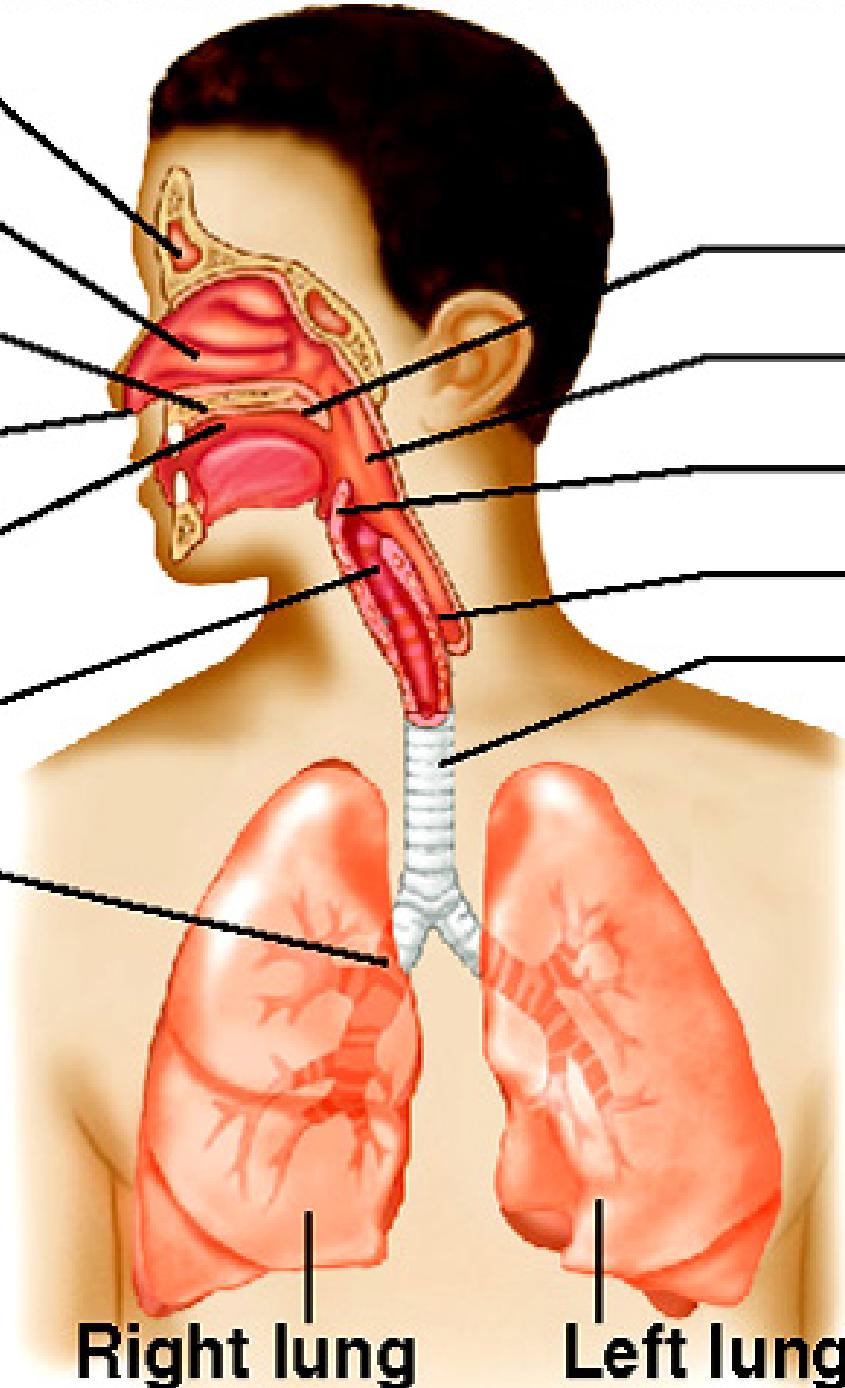
Soft palate

Pharynx

Epiglottis

Esophagus

Trachea

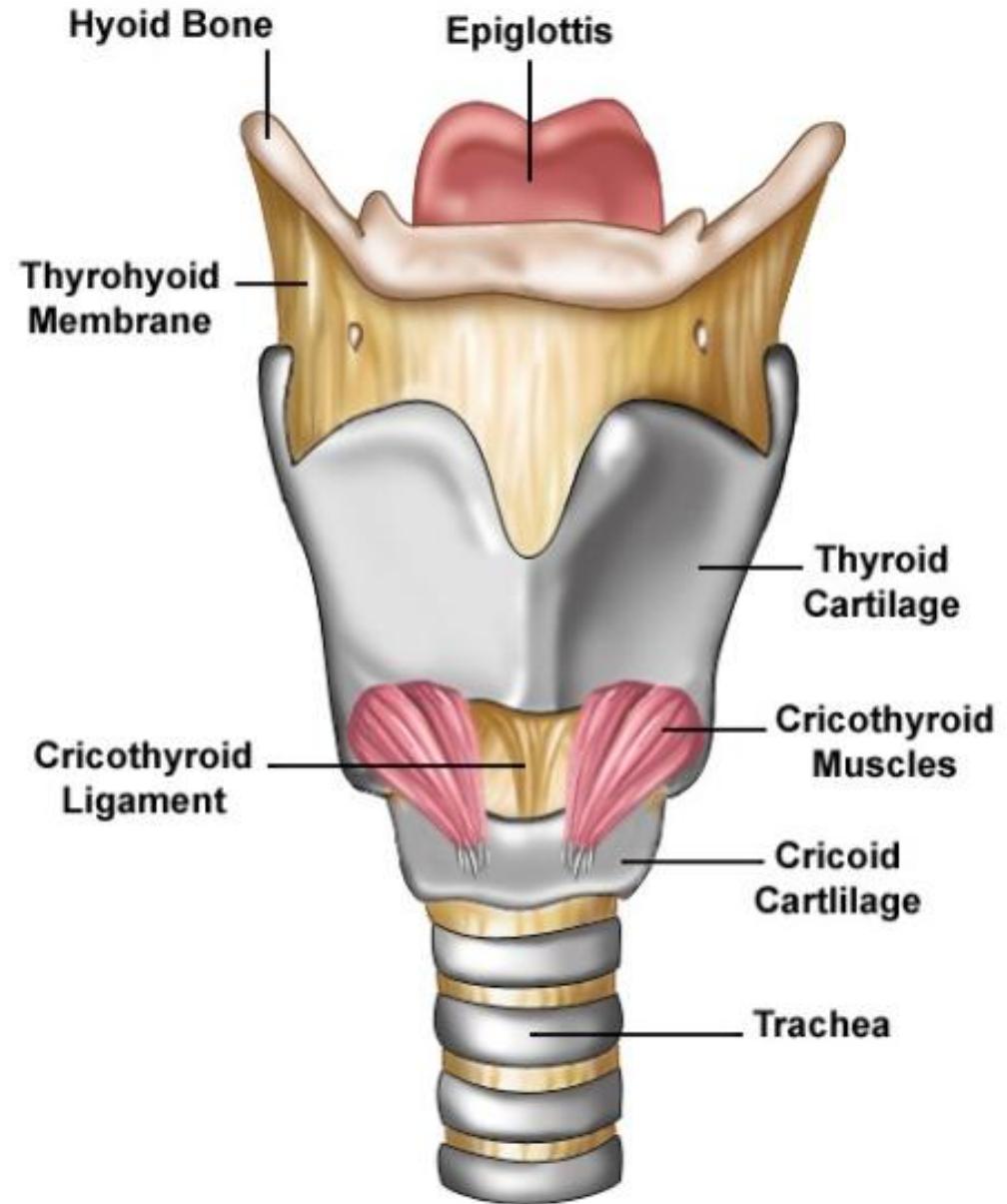


Right lung

Left lung

Larynx –
enlargement at the
top of the trachea
and below pharynx,
conducts air in and
out of trachea,
houses vocal cords

- composed of a
framework of
muscles and
cartilages (thyroid
(Adam's apple),
cricoids, epiglottic
cartilages)



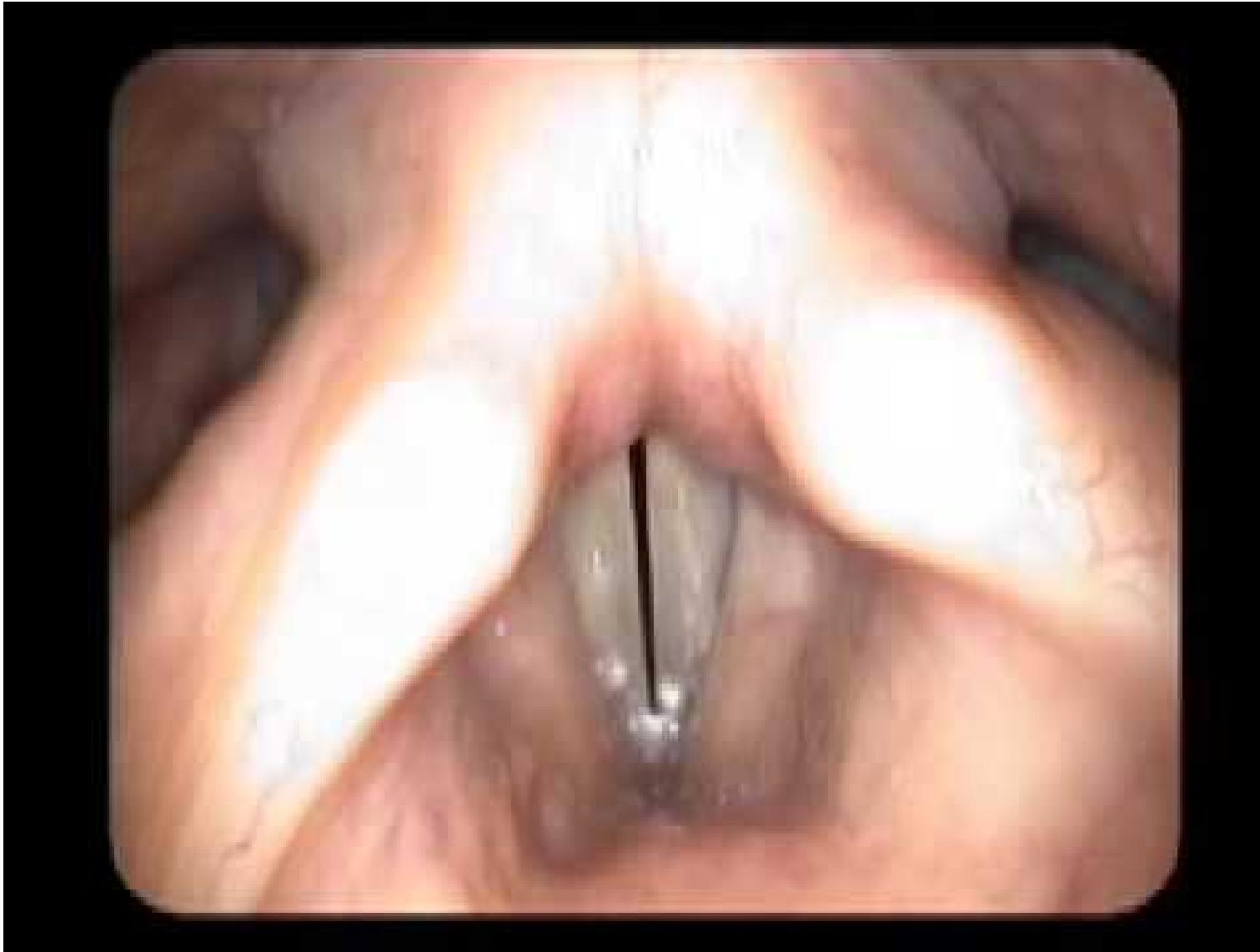
- false vocal folds (do not produce sound) – help close airway during swallowing

- true vocal folds (produce sound) – changing shape of the pharynx, and oral cavity changes sounds into words

- contracting and relaxing muscles changes pitch (increased tension = higher pitch)

Glottis



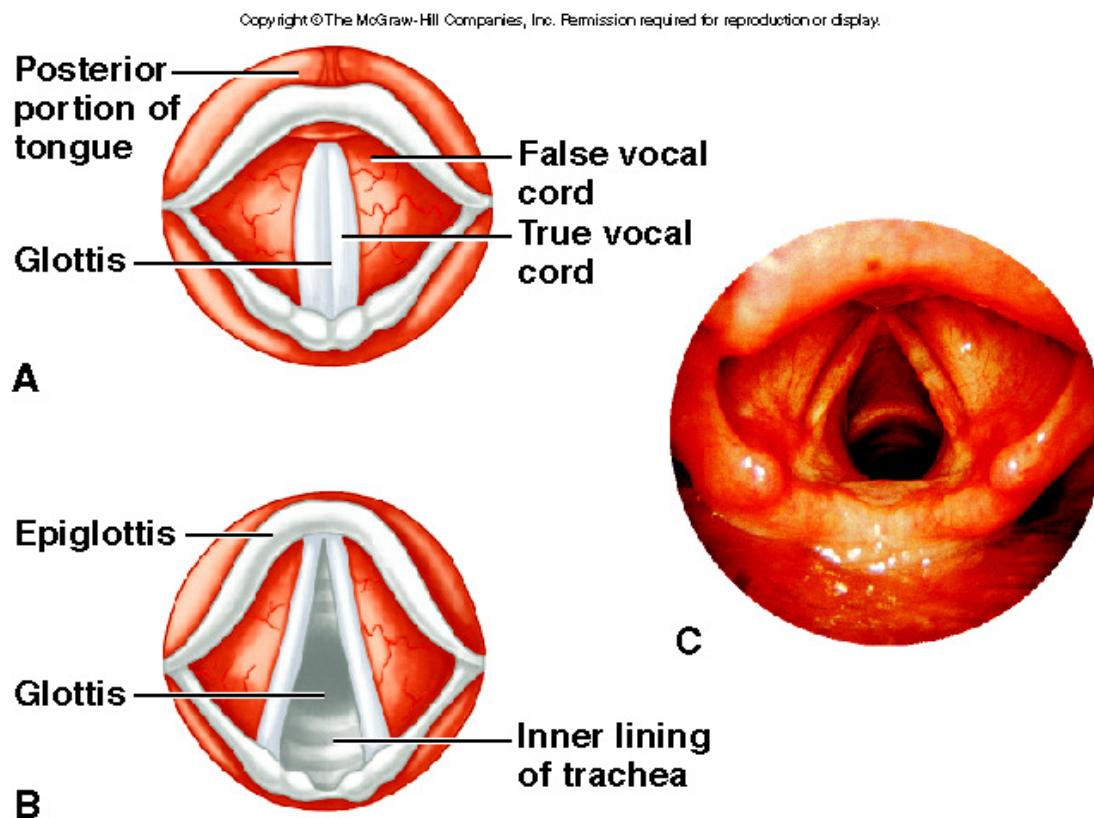


www.voiceinfo.org

[Steven Tyler's Vocal Cords](#)

Glottis – triangular slit that opens during breathing/talking, and closes during swallowing

Epiglottis – flaplike structure that stands upright, allows air to enter larynx, during swallowing it presses downward and prevents food from entering air passages

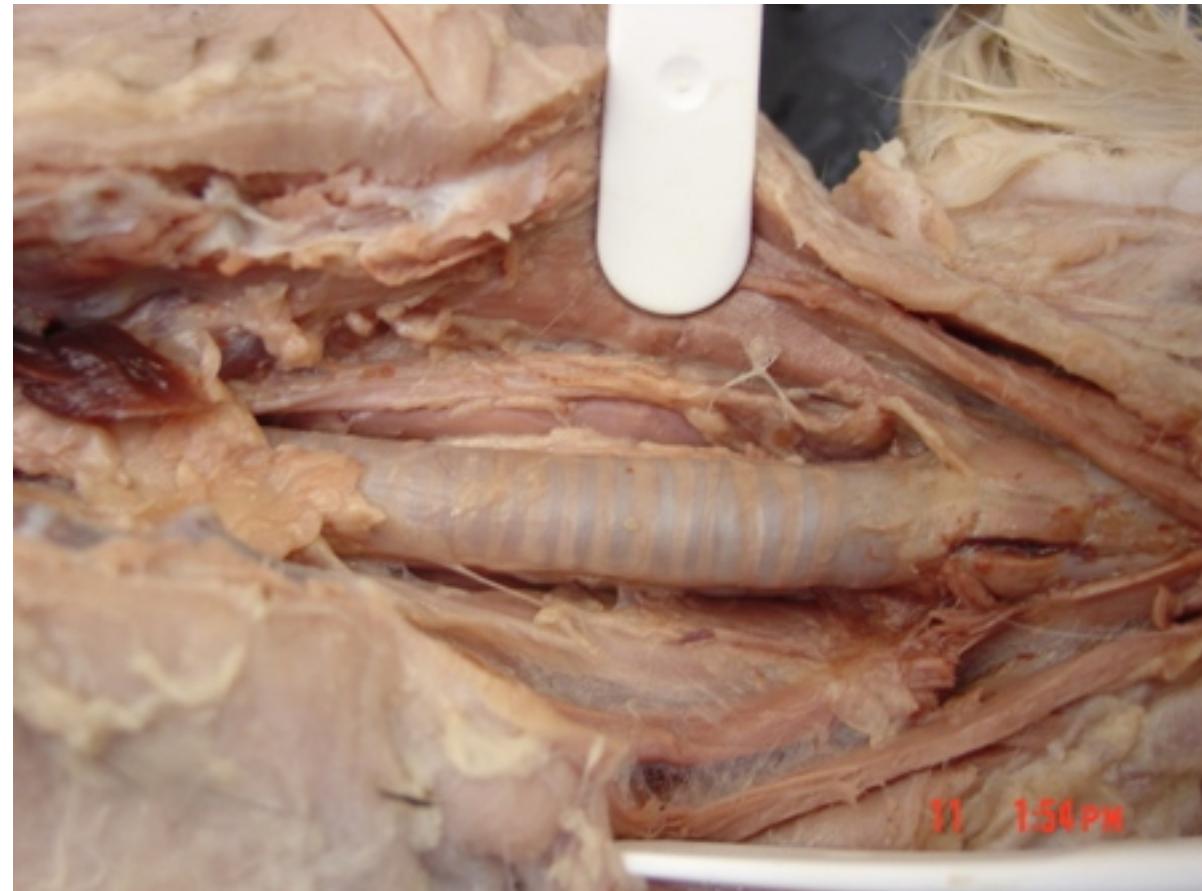


LARYNGITIS

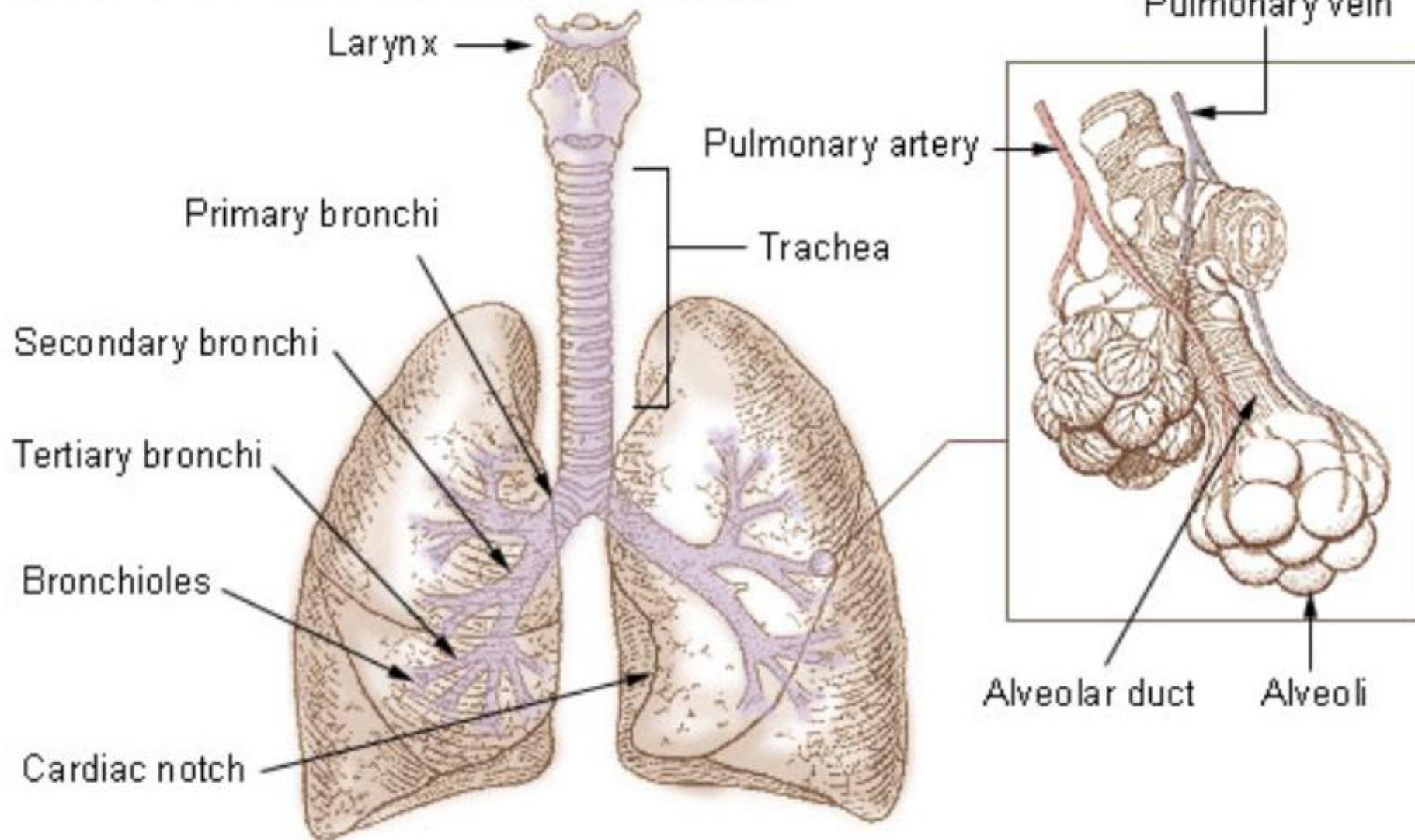
When the mucus membrane becomes swollen and prevents the vocal cords from vibrating freely.

Trachea (windpipe), flexible cylinder with cartilage to give it stiffness and keep it from collapsing

Trachea leads to the BRONCHIAL TREE

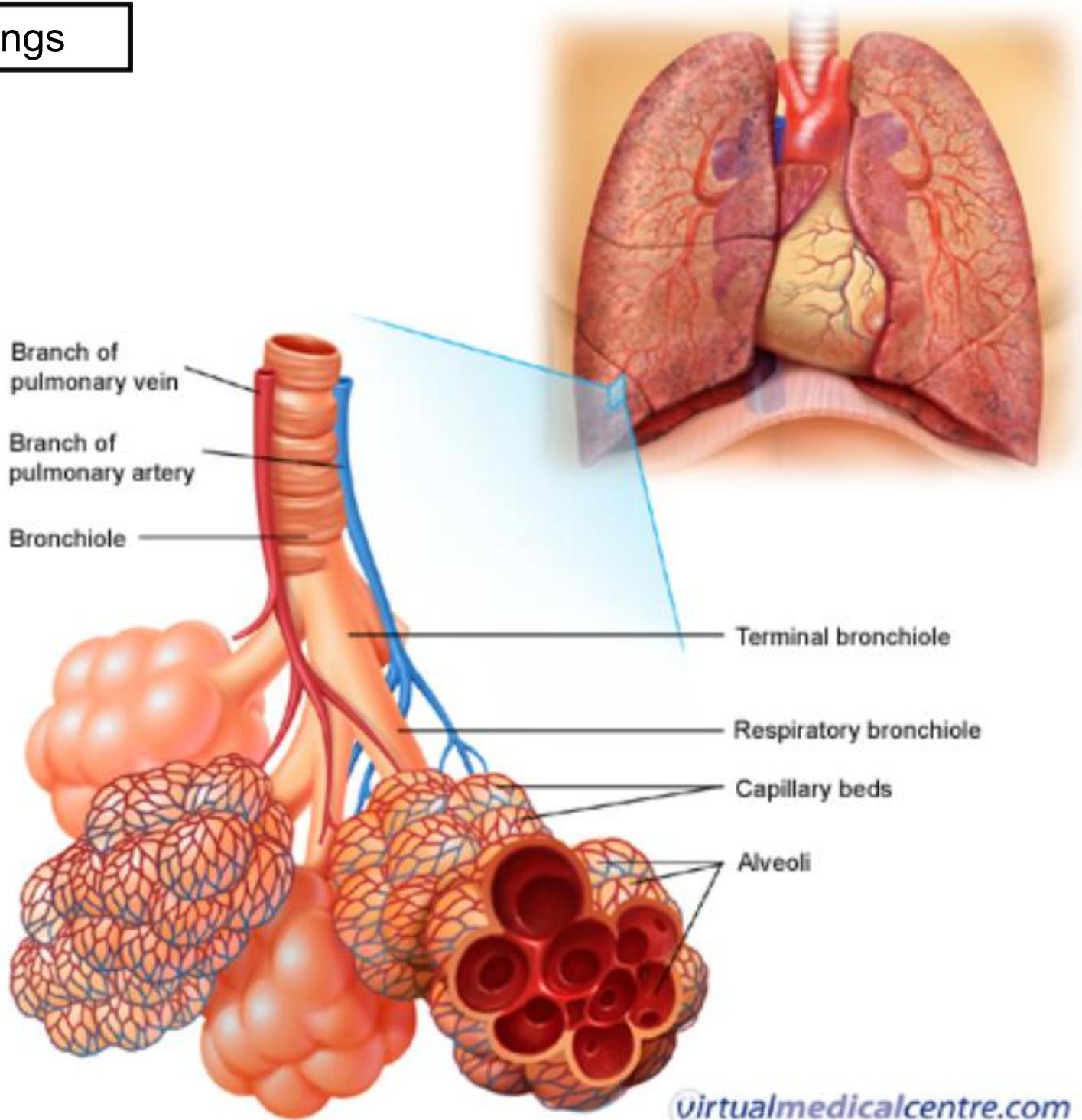


Bronchi, Bronchial Tree, and Lungs

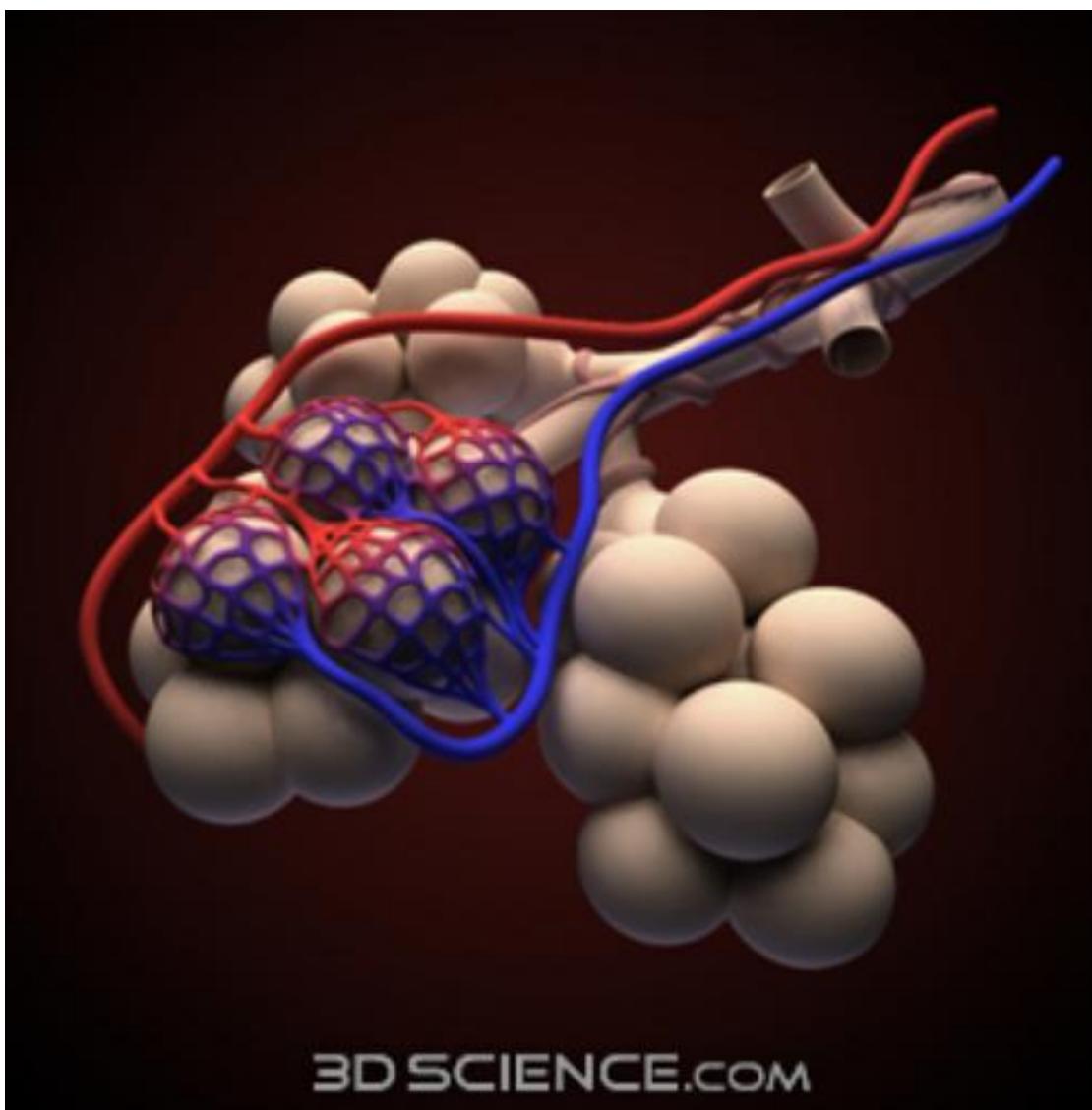


Primary bronchii --> bronchioles --> alveolar ducts --> sacs
--> **alveoli**
*gas exchange

Alveoli & Lungs

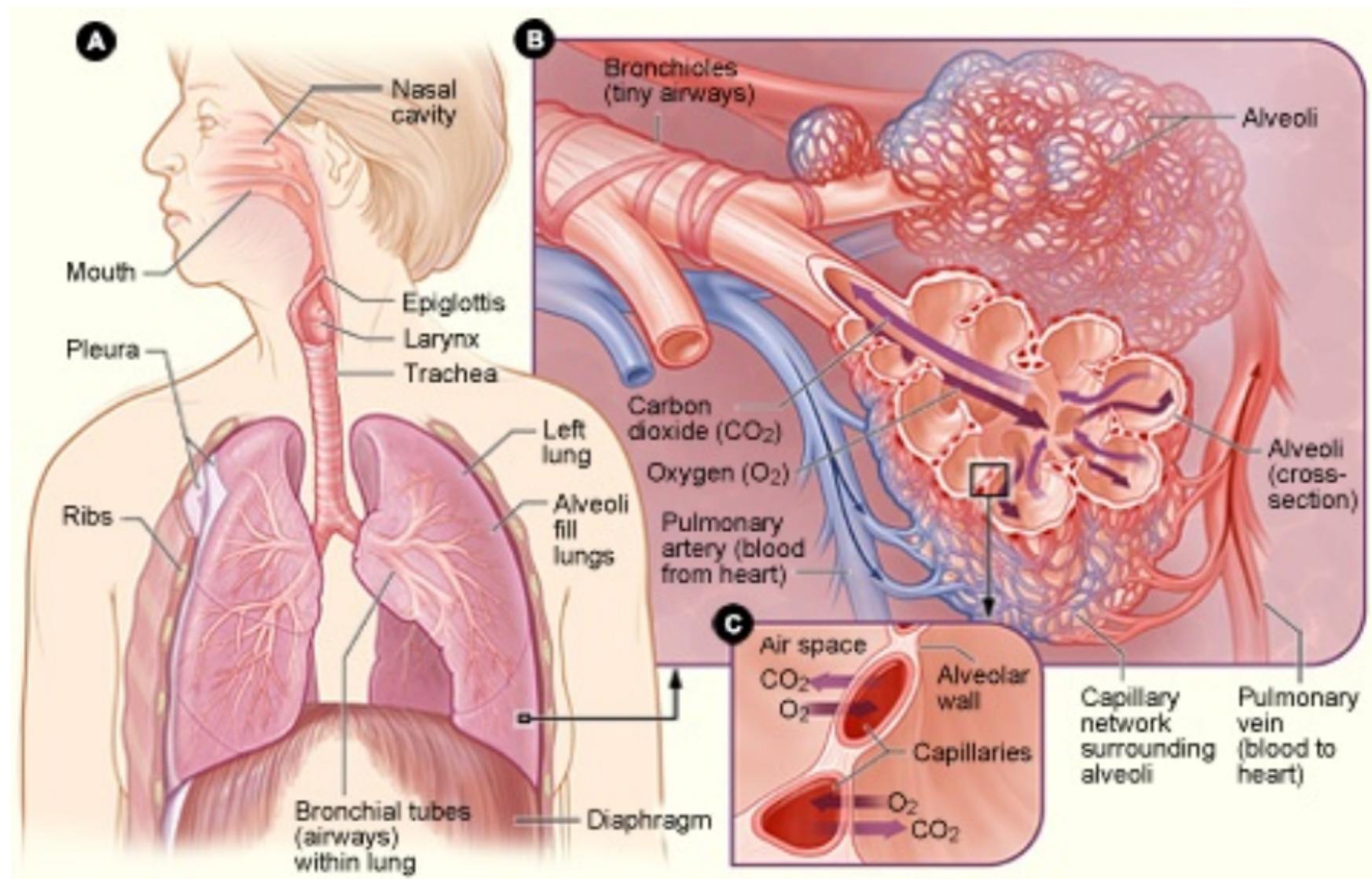


ALVEOLI



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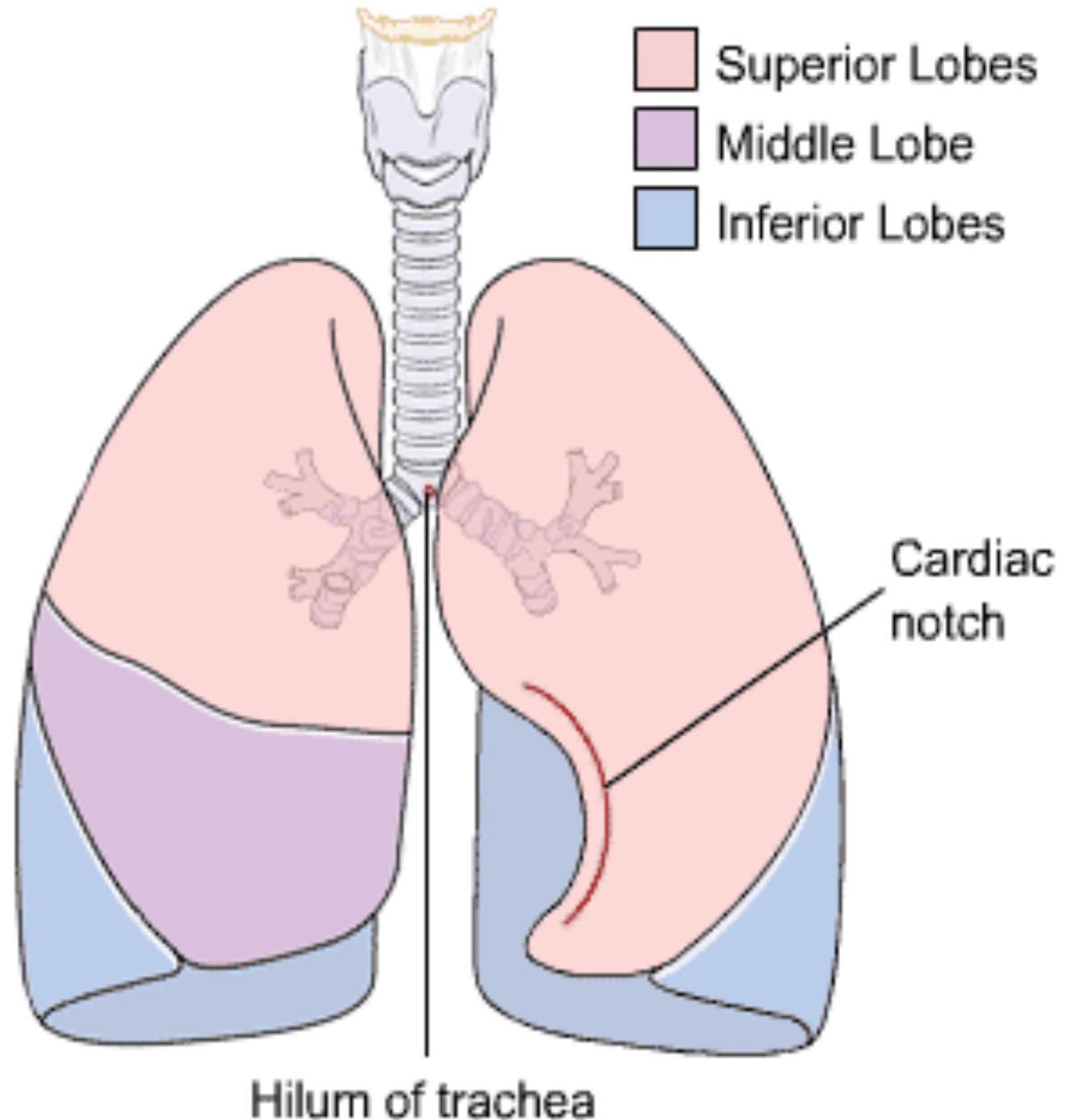
LUNGS - spongy tissue that sit within the pleural cavity



Right Lung
= 3 lobes

Left Lung
= 2 lobes

Serous fluid
lubricates lungs
during breathing

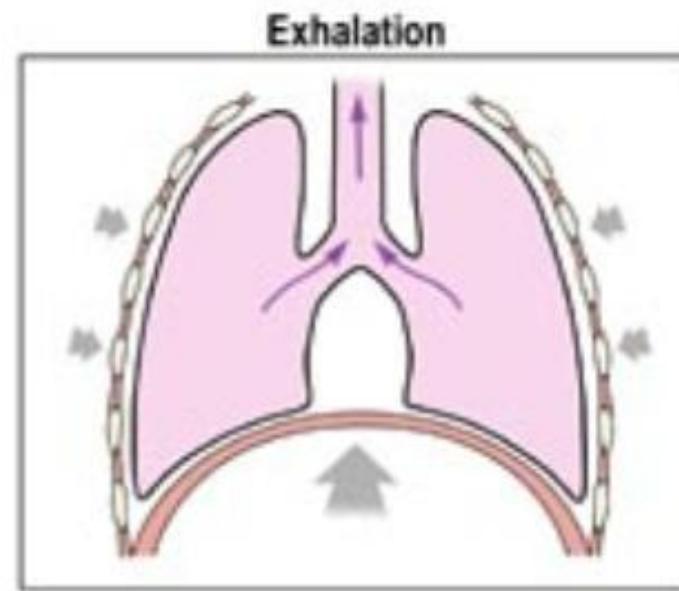
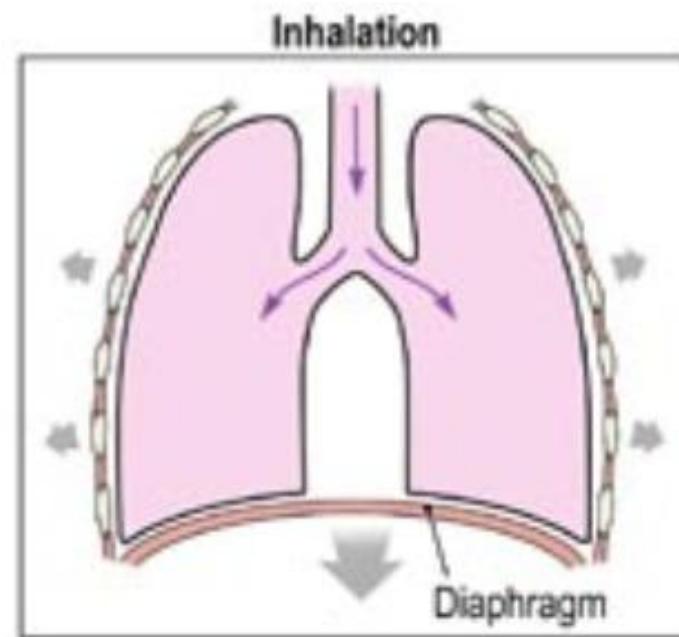
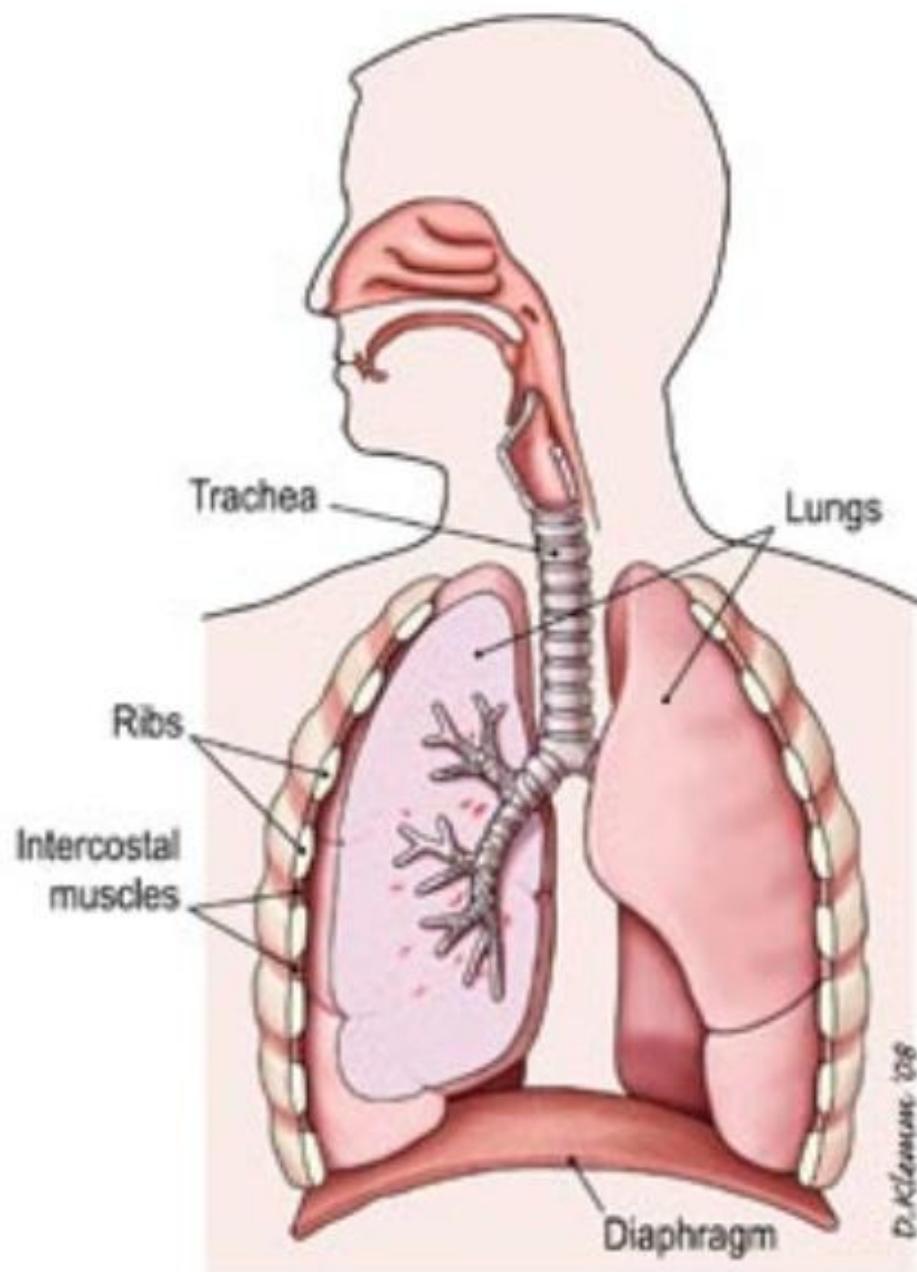


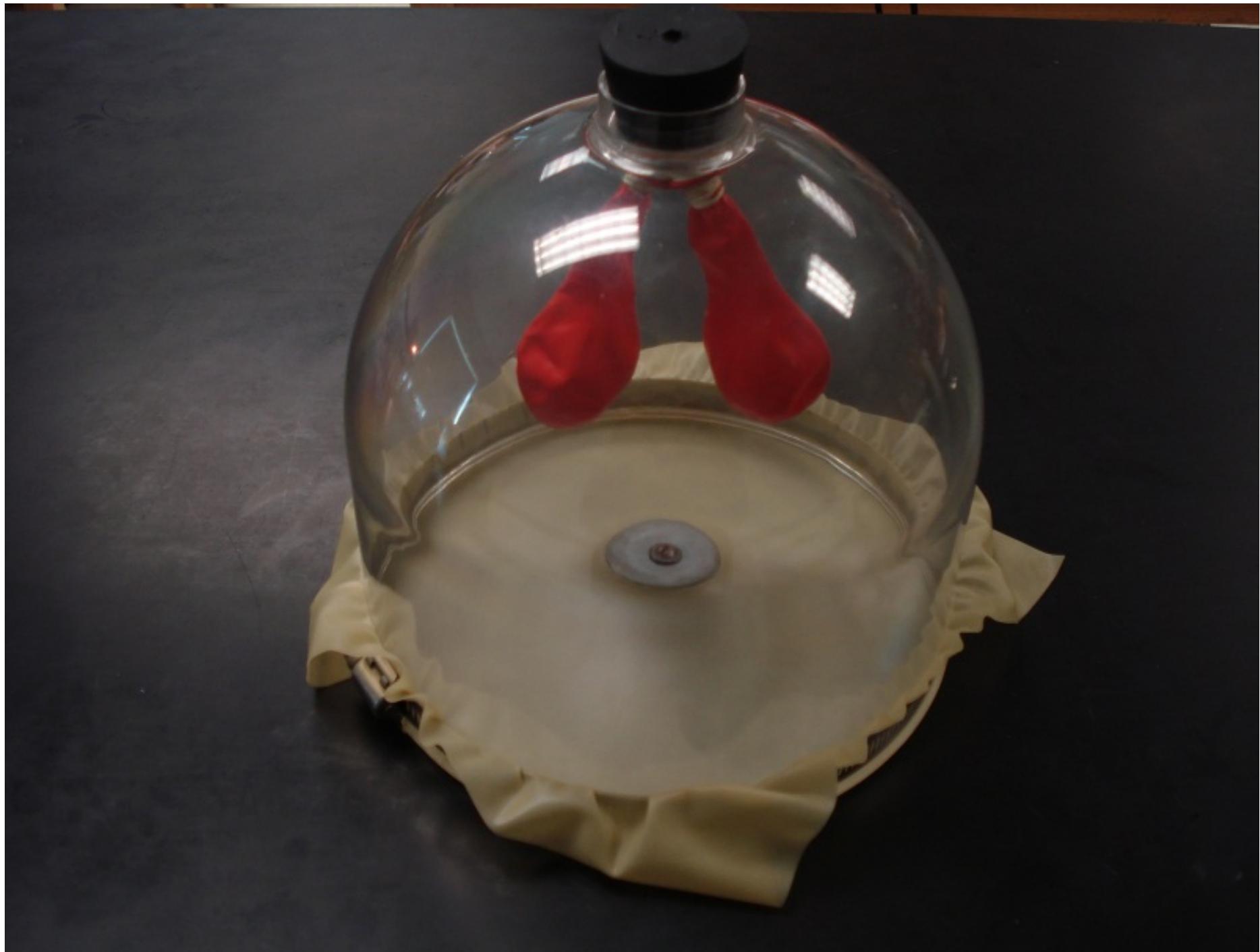
Quick Quiz

1. What do you call the bones found within the nasal cavity?
2. What specific bone divides the nasal cavity into two sides?
3. The space at the back of the mouth is the_____.
4. The spaces within the bones of the skull are called the _____

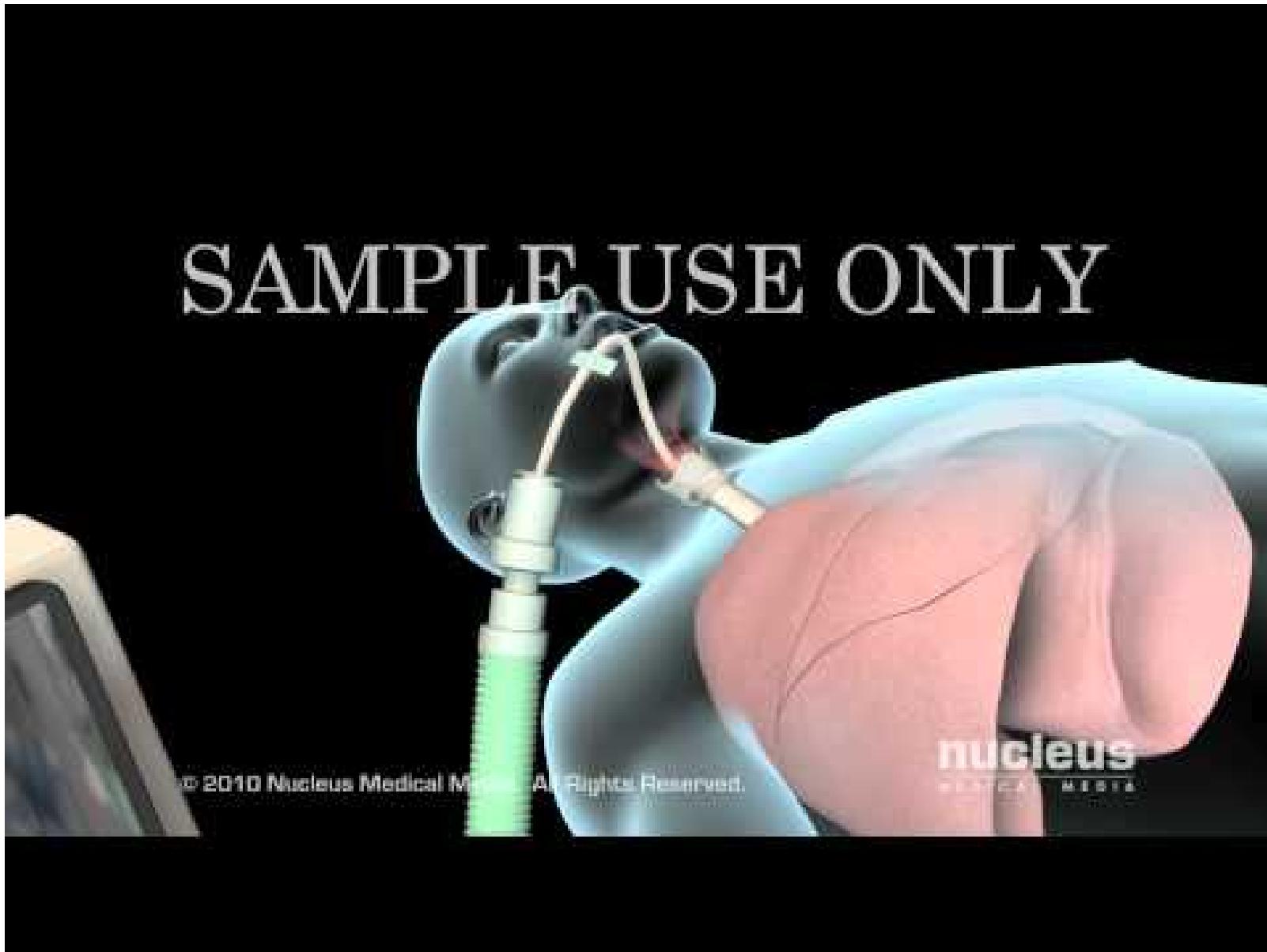
5. What structure is known as the windpipe? _____
6. What is the triangular slit that opens during breathing and talking?
7. In what structures does gas exchange occur?
8. During swallowing, this flap closes to prevent food from entering the airway: _____

BREATHING MECHANISM





Gas Exchange and Intubation



1. Diaphragm moves down, forcing air into airways
2. Intercostals contract, enlarging cavity even more
3. Membranes move with the contractions
4. Surface tension in alveoli and **surfactant** keep them from collapsing
5. Other muscles (pectoralis minor and sternocleidomastoid) can force a deeper breath
6. The first breath in newborns is the hardest due to lack of surfactant

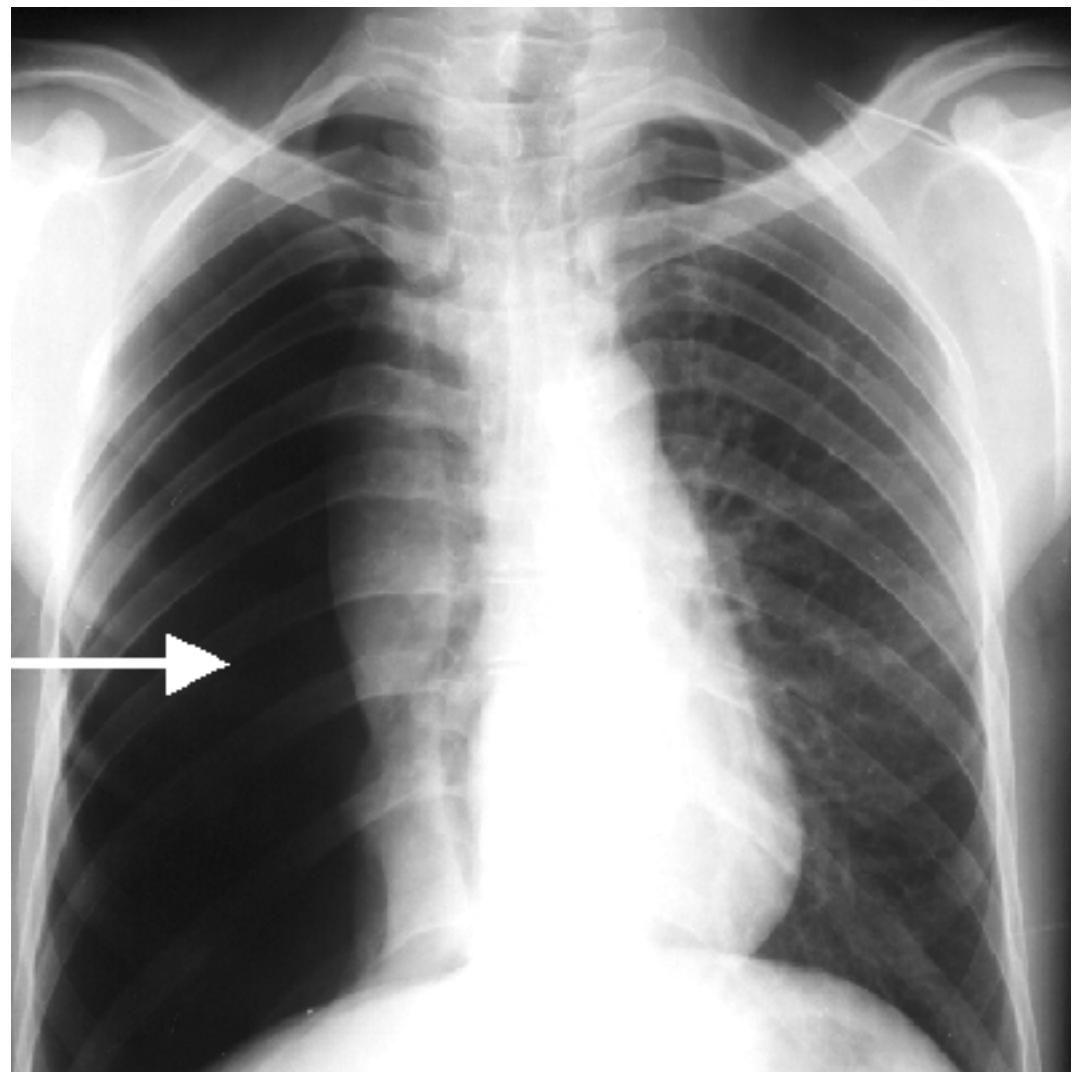


ATMOSPHERIC PRESSURE = 760 Hg

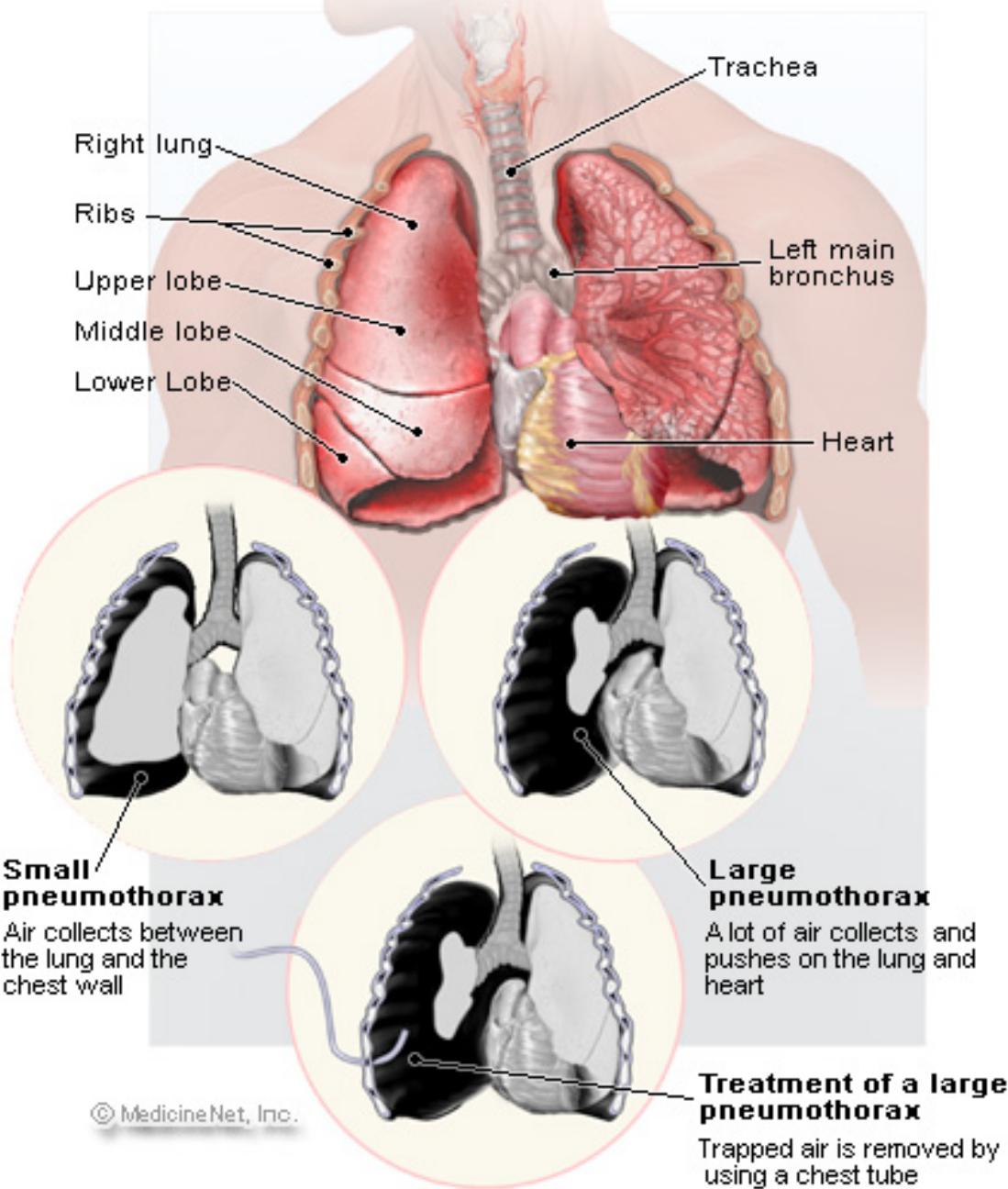
Pressure is necessary for breathing, which is why it is difficult to breathe in high altitudes and also why a punctured lung can be dangerous.

A hole in the pleural cavity can cause the lung to collapse or deflate

Pneumothorax = collapsed lung: [See Video](#)



Pneumothorax

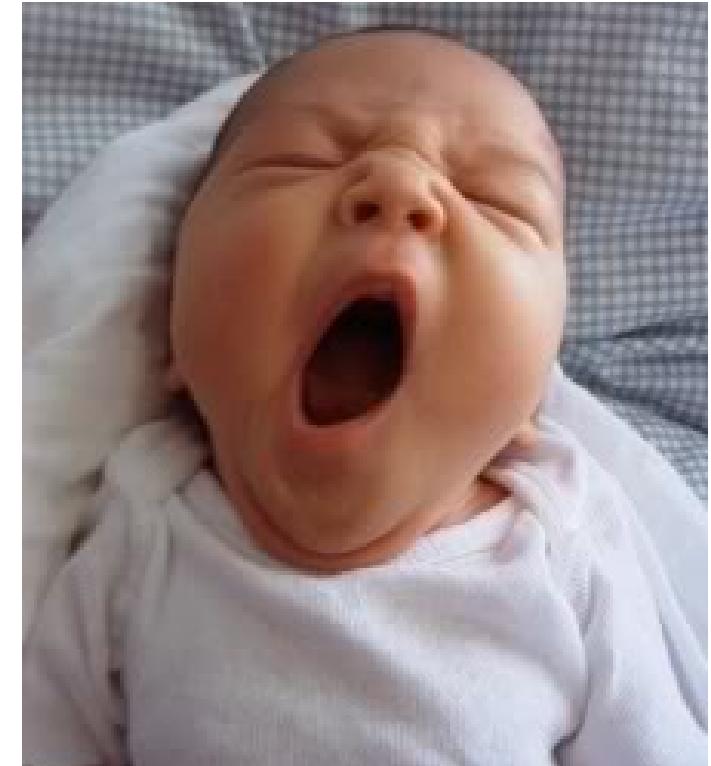


NON RESPIRATORY MOVEMENTS

Coughing, sneezing,
laughing, crying

Hiccup - spasm of the
diaphragm

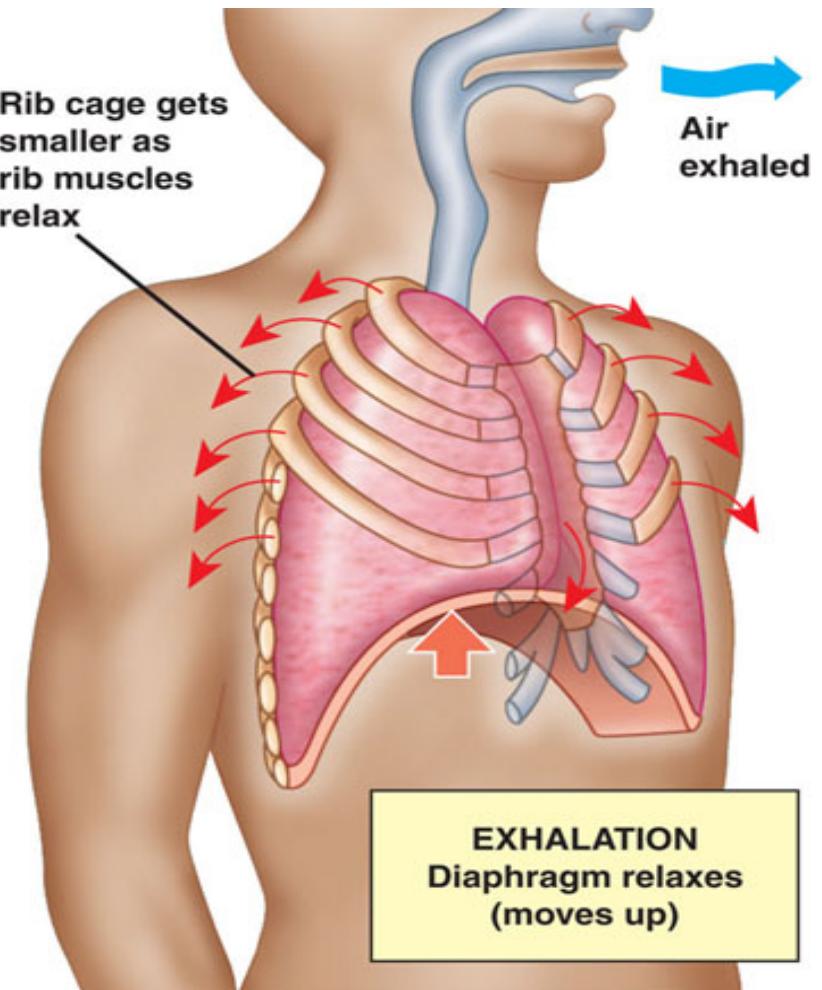
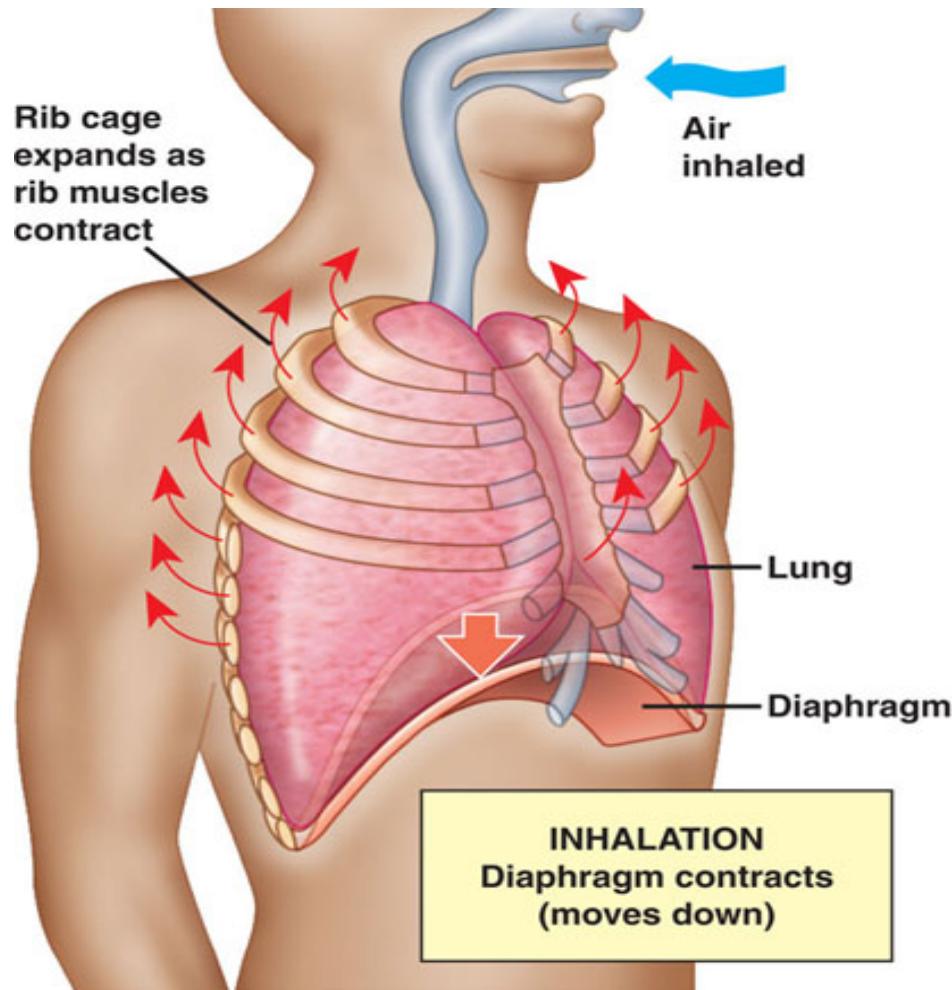
Yawn - possibly caused by
low oxygen levels



EXHALATION

As the diaphragm and other muscles relax, ELASTIC RECOIL from surface tension forces air out.

Muscles can force extra air out or in



Pneumothorax

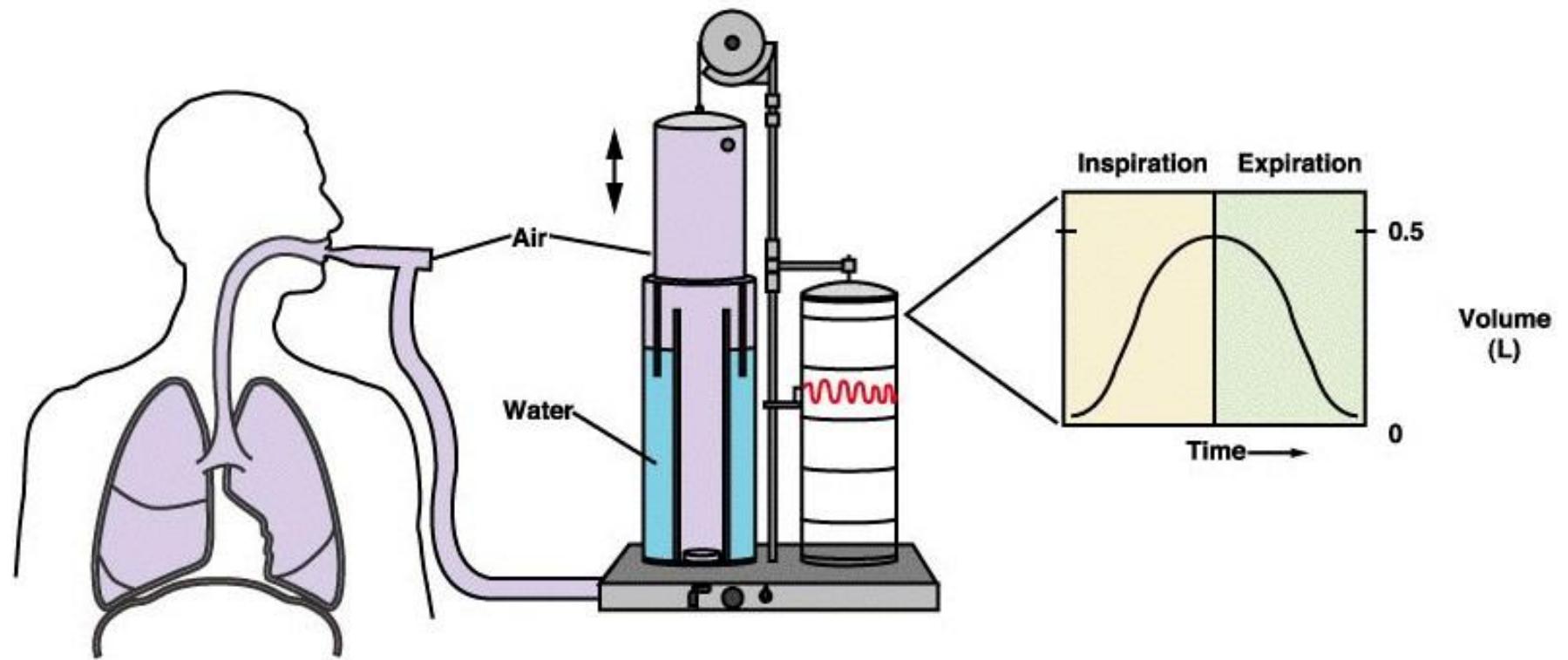


Also check out this [procedure](#) where fluid is drained from the lungs - not for those with a weak stomach!

Respiratory Air Volumes

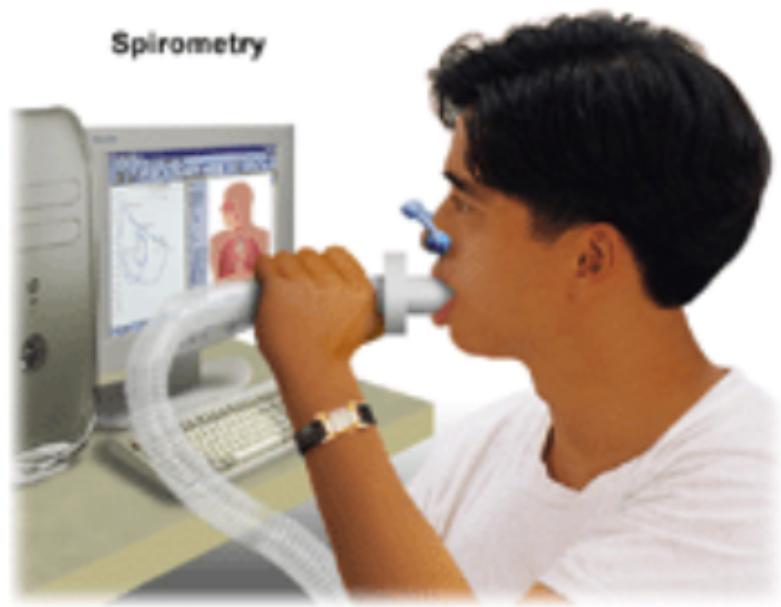
Spirometry - measures the amount (volume) of air moving in and out of the lungs

Respiratory Cycle - 1 inspiration and 1 expiration



Resting Tidal Volume -
amount of air that enters
the lungs during one cycle

Spirometry



*take a normal breath

Reserve volumes - air that can be
forced out or in

*inhale normally, pause, and try to
inhale more - that is your reserve
inspiratory volume

*exhale, then exhale a little more



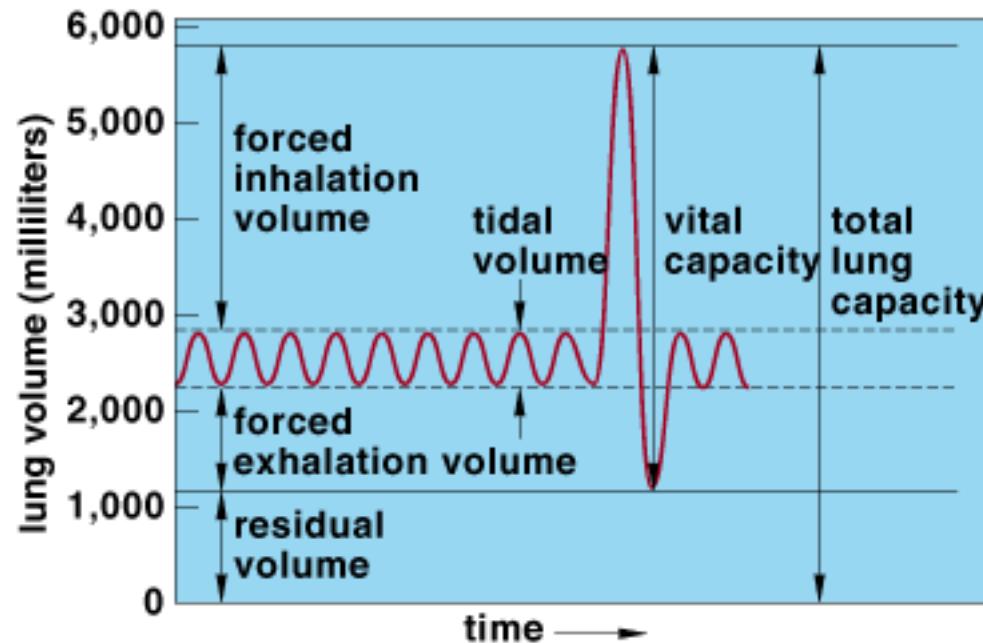
This respirometer has a tub filled with water. When you blow into the tube, the device raises and measures the lung capacity by how much the middle compartment rises.

VITAL CAPACITY = Insp reserve + Exp reserve + Tidal Volume

INSPIRATORY CAPACITY = Tidal Volume + Insp Reserve Volume

FUNCTIONAL RESIDUAL CAPACITY is the volume of air that remains in the lungs at rest

TOTAL LUNG CAPACITY varies by sex, age, body size, athletics



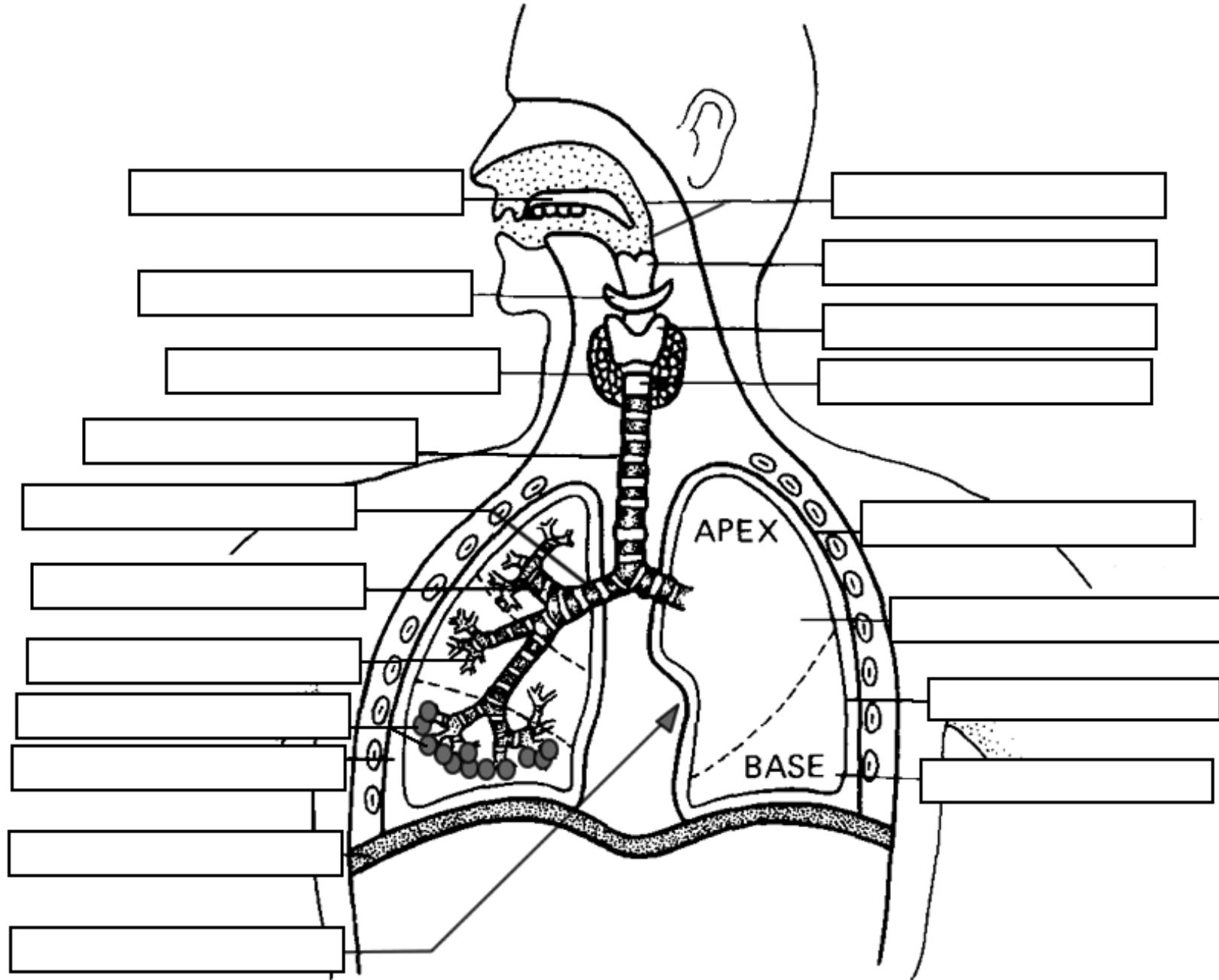
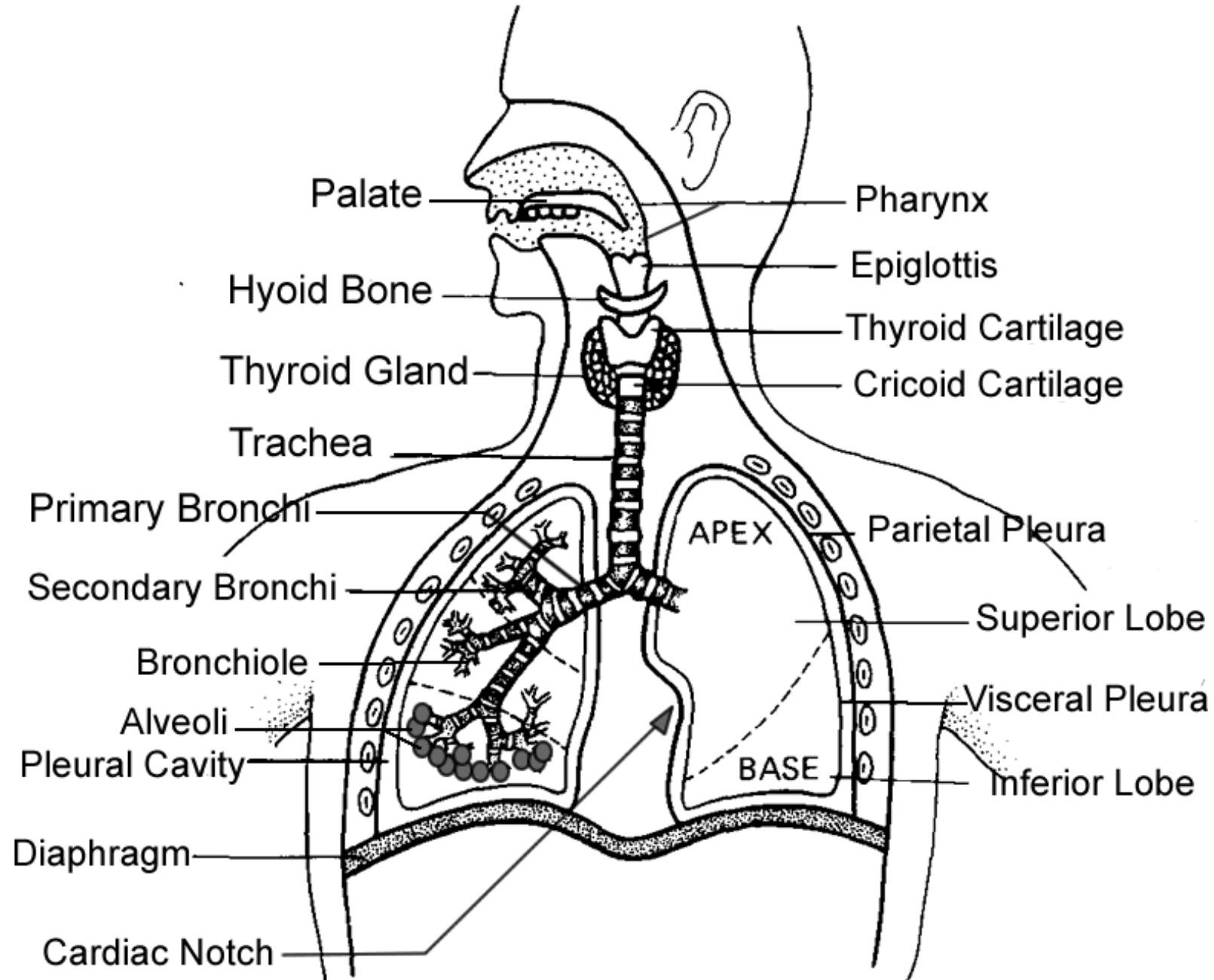


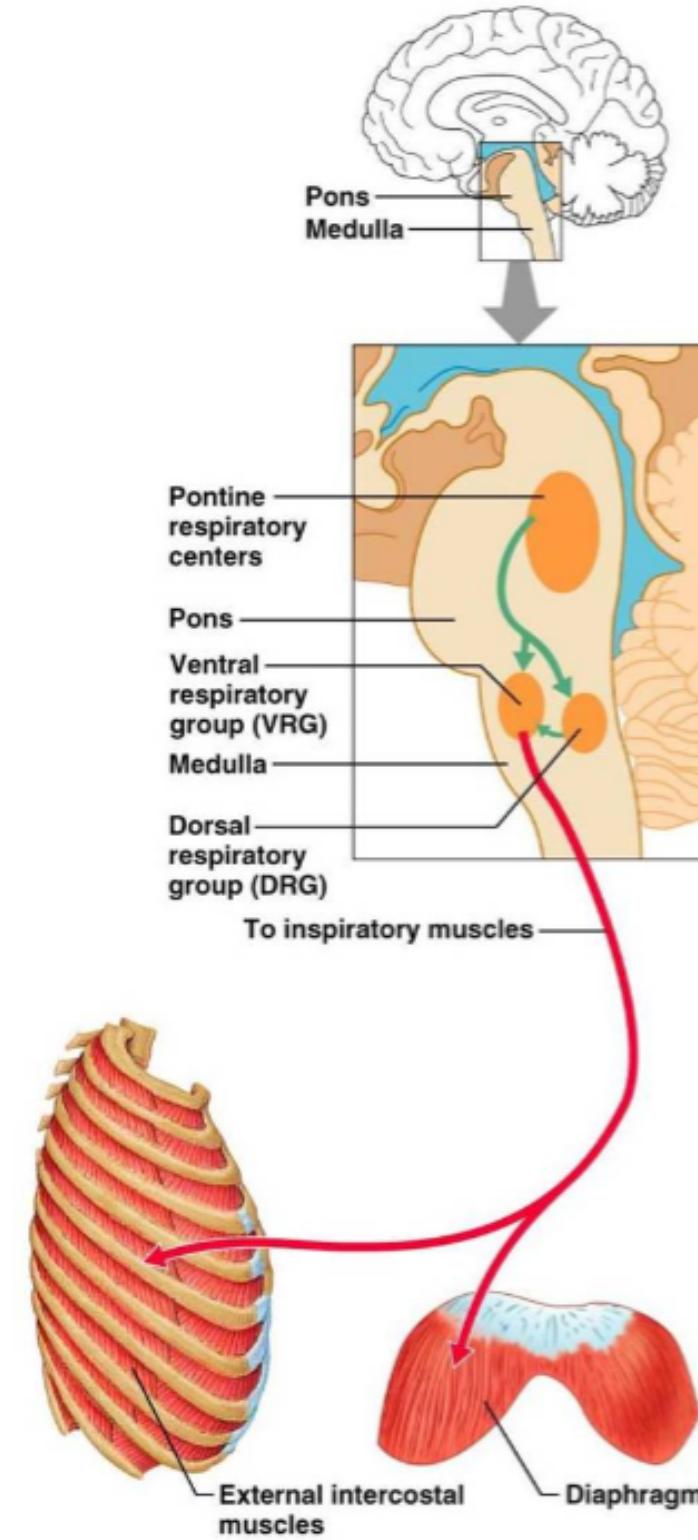
Image adapted from <http://www.arthursclipart.org/>



Breathing is involuntary, but muscles are under voluntary control

Respiratory Center –
groups of neurons in the
brain that control
inspiration and
expiration

(based in the medulla
and the pons)



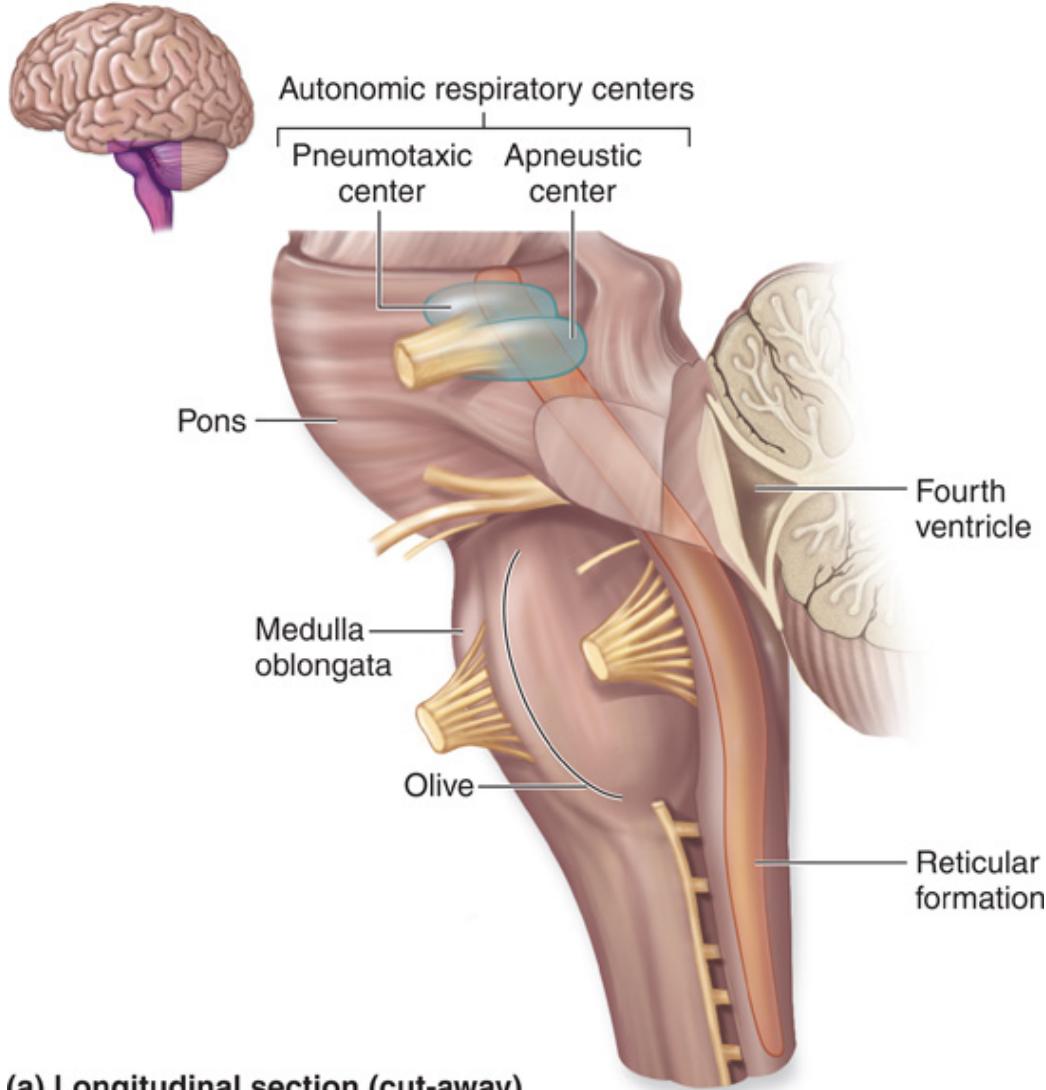
Medulla Rhythmicity Area

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Dorsal Respiratory Group
(rhythm)

Ventral Respiratory Group
(forced)

Pneumotaxic Area
(pons) - inhibit

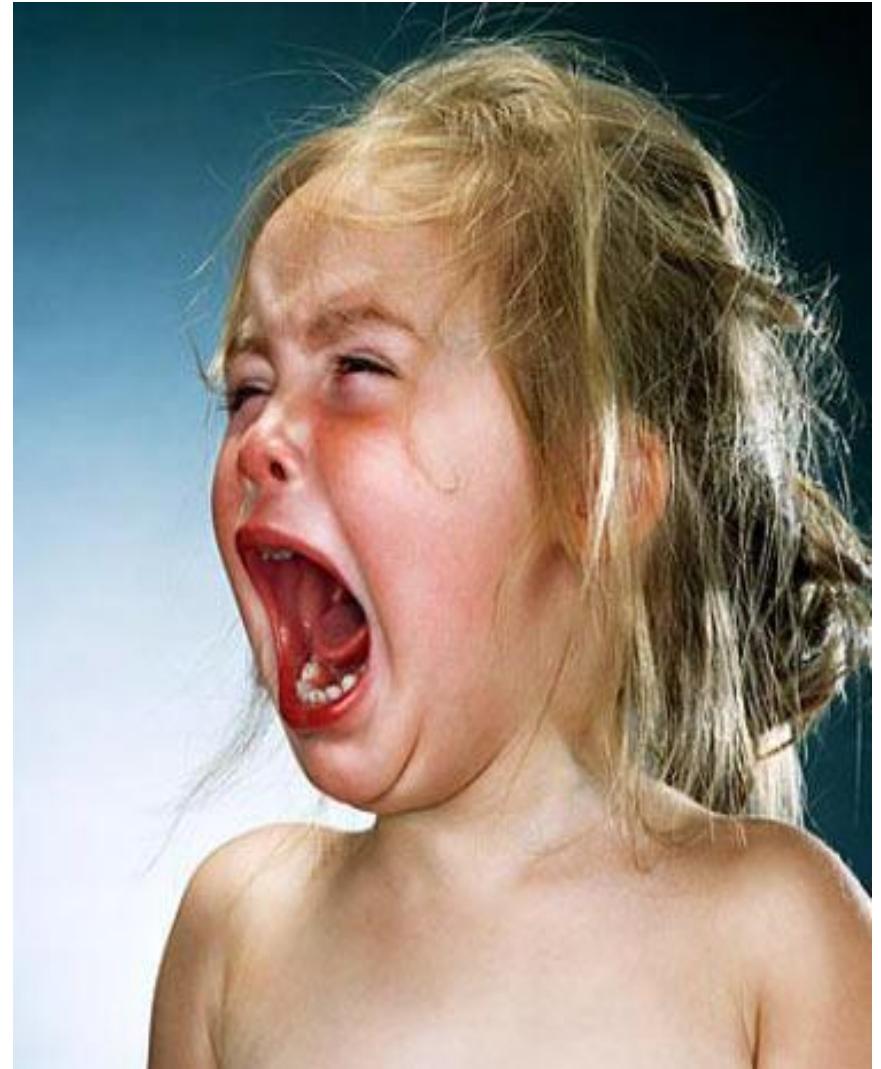


(a) Longitudinal section (cut-away)

Factors Affecting Breathing

*Chemosensitive areas – detect concentrations of chemicals like carbon dioxide and hydrogen

1. Rise in CO₂
2. Low blood oxygen (peripheral chemoreceptors, carotid and aortic bodies, sense changes)
3. Inflation reflex – regulates the depth of breathing, prevents overinflation of the lungs
4. Emotional upset, fear and pain



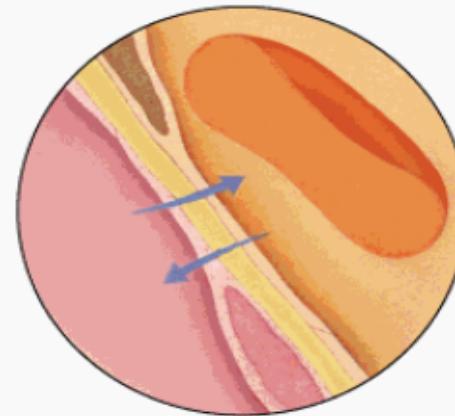
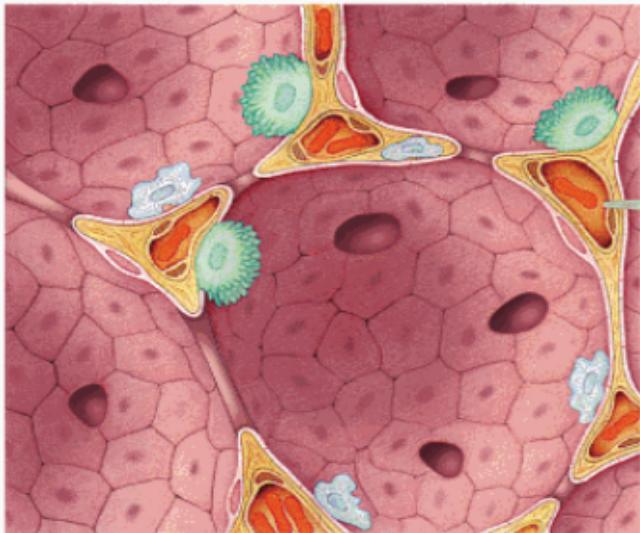
Hyperventilation - increase breathing, lower CO₂ concentration

Breathing into a bag
can restore CO₂
concentrations



Respiratory Membrane – alveoli and blood

st



Gas exchange occurs across a membrane -
a layer of simple squamous cells

Oxygen DIFFUSES into the bloodstream

Other substances (like alcohol can diffuse too)



Hypoxia is a disease in which there is an overall lack of oxygen content within the body's tissue and vital human organs (specifically the brain).

Hypoxia has several potential causes, including: cardiac arrest, severe head trauma, carbon monoxide poisoning, suffocation, strangulation, and choking, as well as any instance in which oxygen supply is deprived from the body.

Asphyxia is a condition of severely deficient supply of oxygen to the body that arises from being unable to breathe normally.

An example of asphyxia is choking. Asphyxia causes generalized hypoxia, which primarily affects the tissues and organs.



ILLNESSES RELATED TO THE RESPIRATORY SYSTEM

1. Cystic Fibrosis (genetic)
2. Asthma
3. Bronchitis
4. Apnea
5. Emphysema
6. Lung Cancer
7. Altitude Sickness
8. Chronic Obstructive Pulmonary Disease (COPD)
9. Sinusitis
10. Bacterial or Viral Infections (cold, flu, pneumonia)

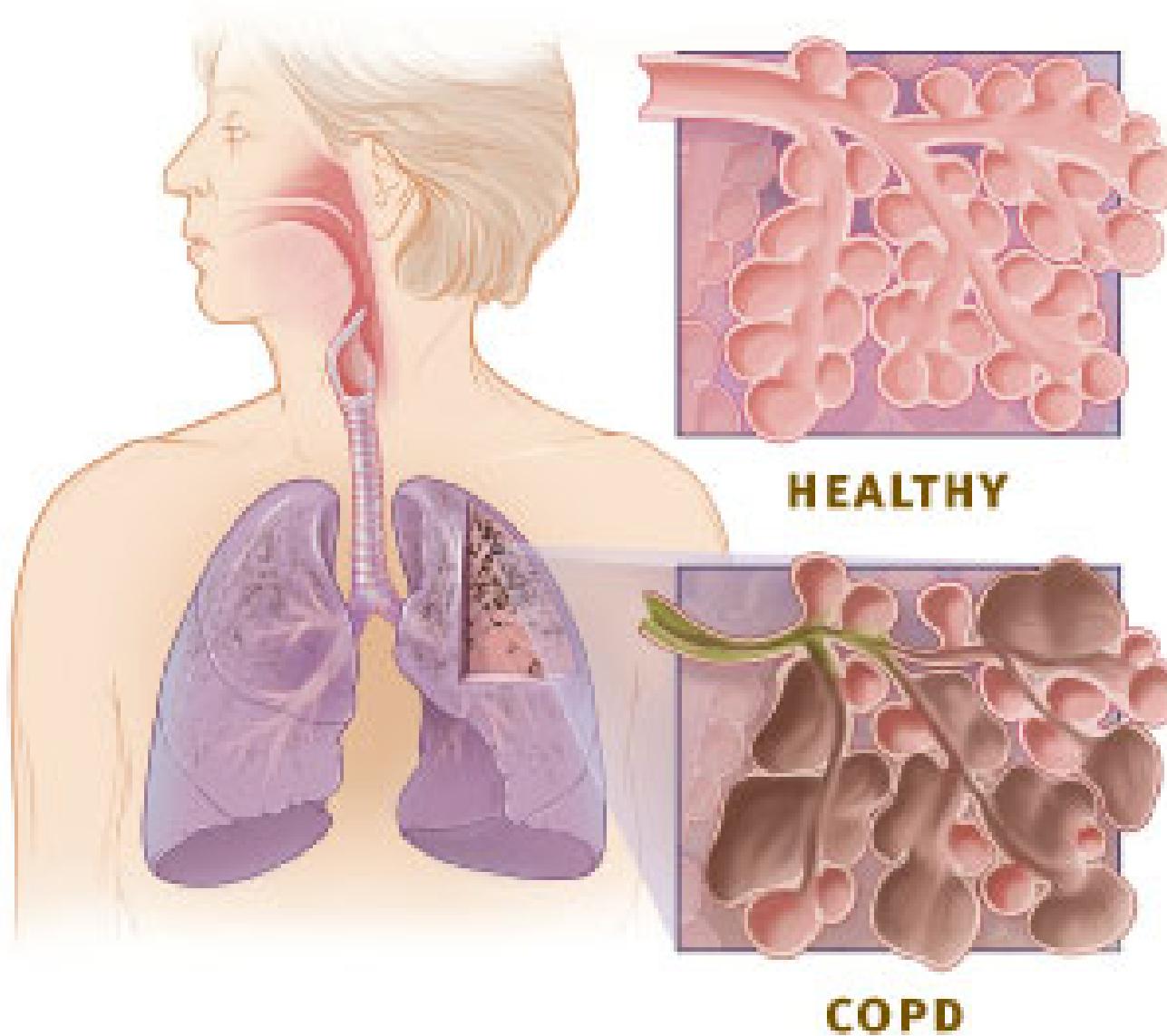


Cystic Fibrosis - hereditary disease,
mucus clogs the lungs.

Two parents can be carriers: Ff x Ff
and produce a child with the disease: ff

Chronic obstructive pulmonary disease, or COPD, is a long-lasting obstruction of the airways that occurs with chronic bronchitis, emphysema, or both. This obstruction of airflow is progressive in that it happens over time.

SMOKING IS THE MOST COMMON CAUSE OF COPD & EMPHYSEMA





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Normal bronchi



Bronchitis



ADAM.

Bronchitis is inflammation of the main air passages to the lungs. Bronchitis may be short-lived (acute) or chronic, meaning that it lasts a long time and often recurs.

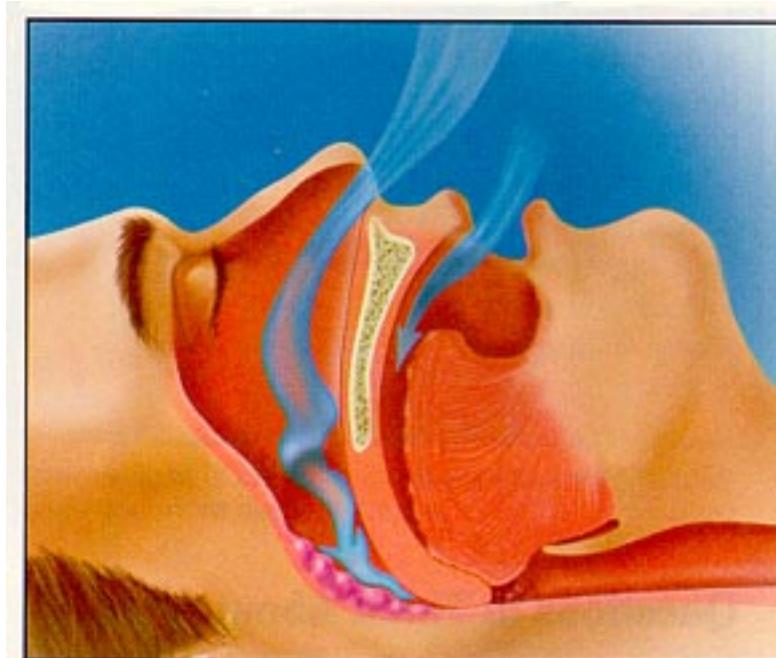


Use ADVAIR only twice a day, every day.

What is sleep apnea?

Pause or slowing of breathing during sleep

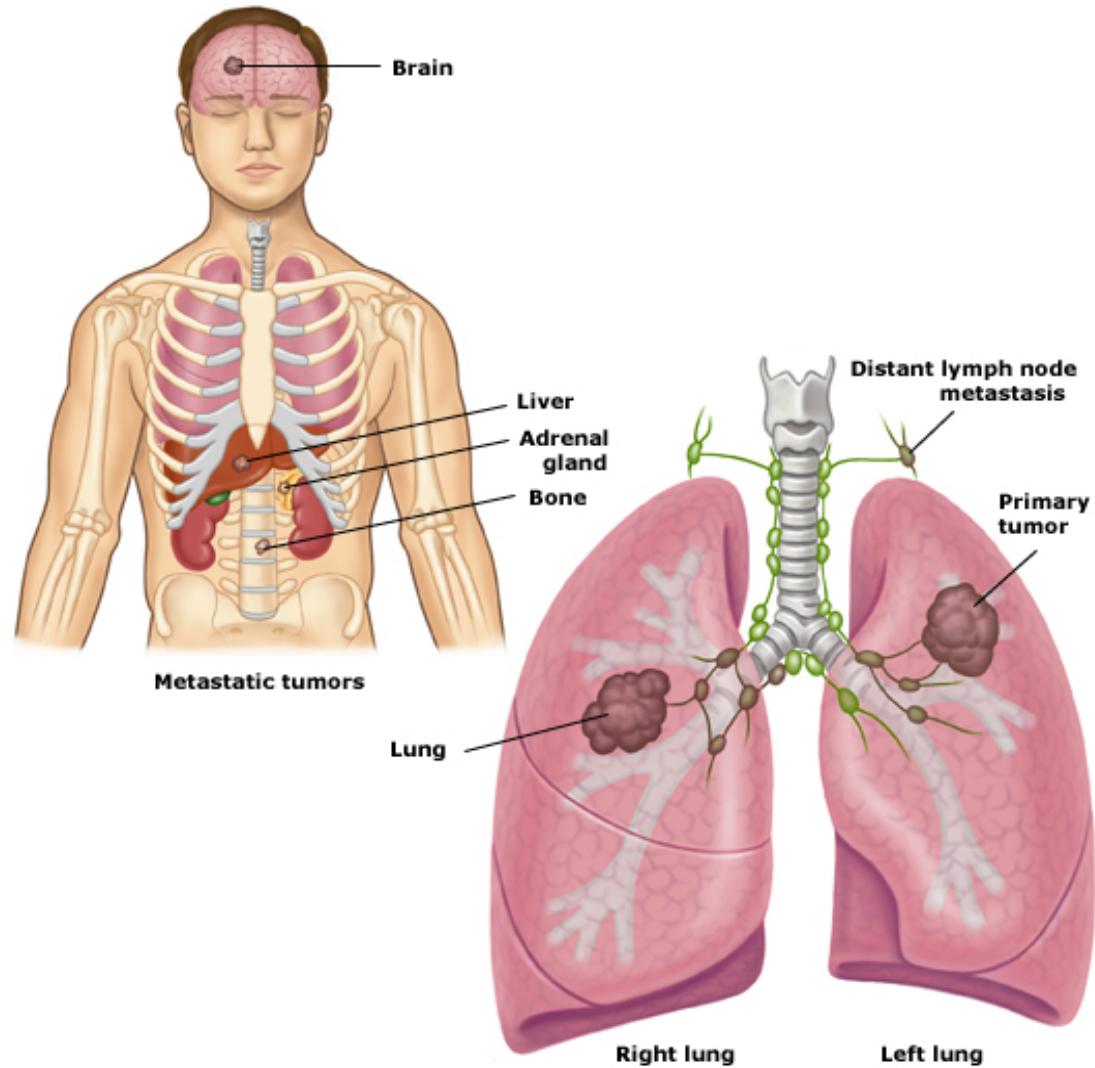
[Video on Sleep Apnea](#)



During sleep apnea, air flow is completely blocked.

Lung Cancer

Lung cancer starts when abnormal cells grow out of control in the lungs. Lung cancer and smoking often, but not always, go hand in hand. There usually are no signs or early symptoms of lung cancer. As lung cancer stages advance, lung cancer symptoms may include coughing, wheezing, shortness of breath, and bloody mucus. Treatment for lung cancer can include surgery, chemotherapy, and /or radiation.



ALTITUDE SICKNESS

Acute mountain sickness is brought on by the combination of reduced air pressure and lower oxygen concentration that occur at high altitudes. Symptoms can range from mild to life-threatening, and can affect the nervous system, lungs, muscles, and heart.

Pulmonary edema is an abnormal build up of fluid in the air sacs of the lungs, which leads to shortness of breath