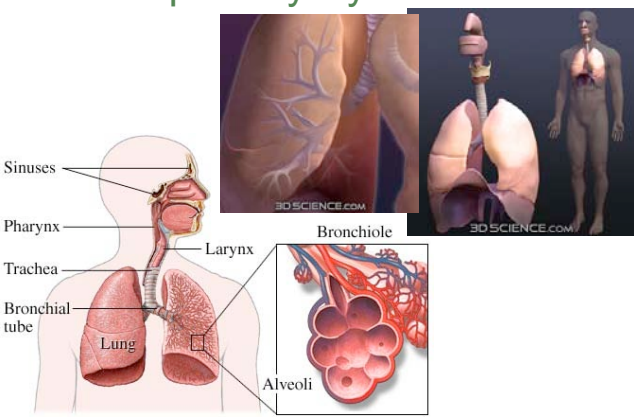
## The Respiratory System




## The nose

Nostrils = *external nares*

Nasal cavity is divided in half by the *nasal septum*

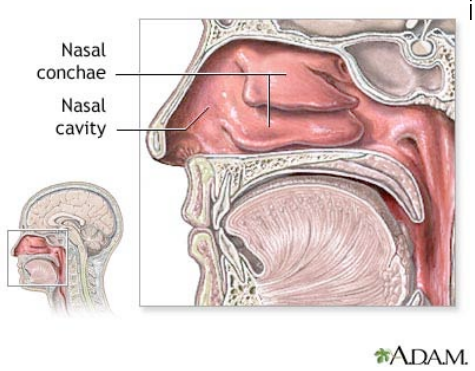
Olfactory receptors are located in superior part of nasal cavity, near *ethmoid bone*

*Respiratory mucosa* is lined by 100s of veins, to warm air

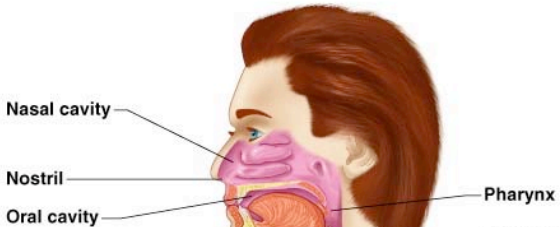
Cilia on respiratory mucosa trap bacteria and other debris; allowing us to swallow it to get destroyed in the stomach

## Nasal conchae

Increa in
nasal
Increa
covere
Increa




## Nasal cavity anatomy




## Pharynx

= your “throat”

Continuous with nasal cavity via the *internal nares*

Divided into *nasopharynx, oropharynx, and laryngopharynx*, which enters the larynx

*Pharyngotympanic tubes* empty into nasopharynx

Pharynx is the side of several clusters of lymphatic tissue (= *tonsils*)

## Larynx

Inferior to pharynx

Formed of 8 rigid hyaline cartilages and the epiglottis (elastic cartilage)

*Thyroid cartilage* protudes anteriorly, forming the “Adam’s Apple”

*Epiglottis* closes over the *trachea* when we swallow, preventing anything but air going into the airways

Folds in mucus membrane form the *vocal folds*, which vibrate, allowing us to speak

## Trachea

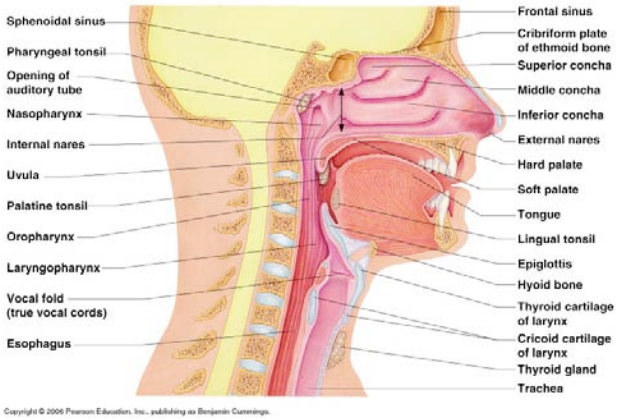
Extends from pharynx to about mid-chest (5th thoracic vertebrae)

Reinforced by C-shaped rings of *hyaline cartilage*

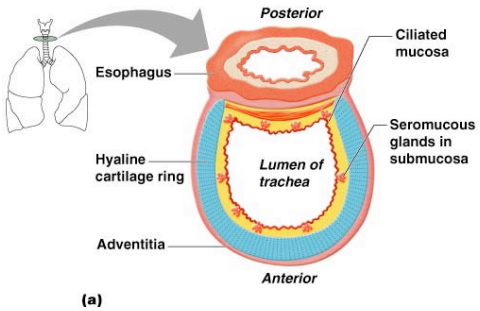
abut the esophagus, allowing it to expand

keep the airway *patent* (= open)

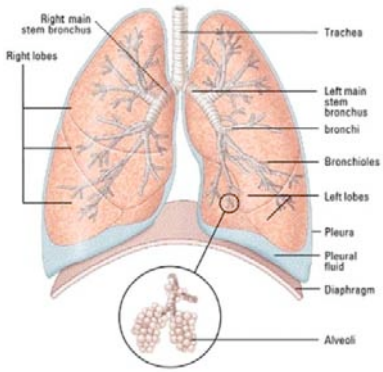
Lined with cilia that beat *away* from the lungs, further filtering out debris, etc.



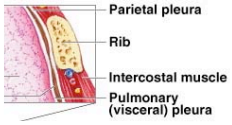




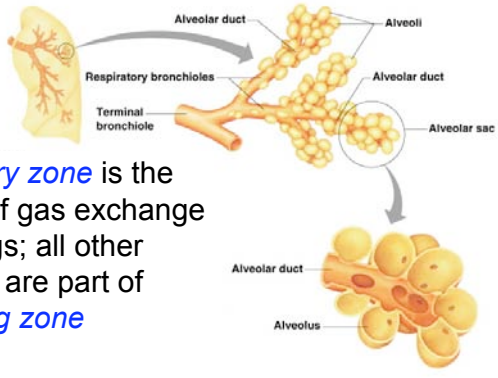

## The lungs







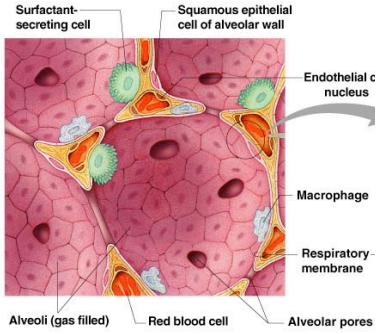

## Respiratory zone structures




*Respiratory zone* is the only site of gas exchange in the lungs; all other structures are part of *conducting zone*



## Respiratory membrane



## Pulmonary ventilation

= breathing

Process depends on *pressure changes* in the thoracic cavity

Gas particles always fill their container

- if there are few gas particles, *pressure is low*
- If there are many gas particles, *pressure will be high*

Breathing consists of two phases: *inspiration*, and *expiration*

## Inspiration

*Diaphragm and external intercostal muscles* contract, increasing size of thoracic cavity

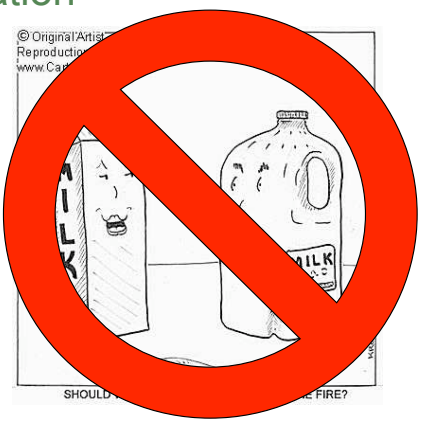
Lungs increase volume with the thorax

*Interpulmonary volume* increases, ***decreasing gas pressure within the lungs***

This *partial vacuum* sucks air into the lungs from the outside

Air moves into lungs until pressure inside and outside of lungs is equal

## Expiration



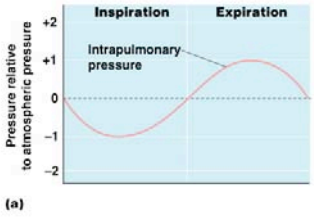

## Expiration

Inspiratory muscles relax

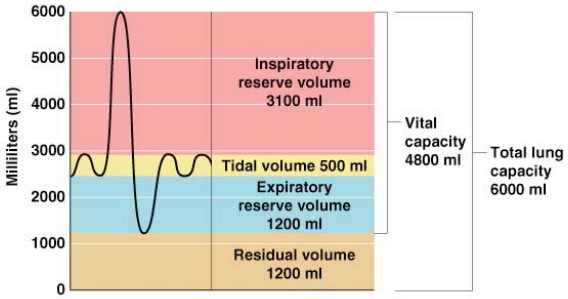
Intrapulmonary volume decreases, ***pressure increases***

Gases equalize pressures

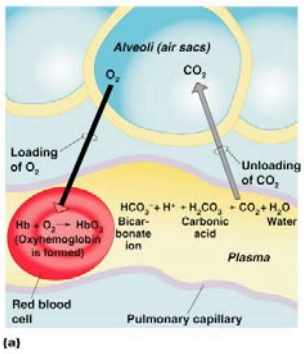
*Intrapleural pressure is always negative-- prevents lungs from collapsing*




## Respiratory volumes and capacities



## Gas exchange






## Control of respiration

Respiratory muscles are controlled by the *phrenic and intercostal* nerves

The *medulla* sets the basic breathing rhythm, and contains the *self-exciting inspiratory center*

The *pons* is responsible for smoothing that basic breathing pattern

Normal respiratory rate (12-15 resps/min) = *eupnea*

## Respiratory influences

Physical factors

Talking, coughing, exercising all modify the rate and depth of our breaths; increased body temperature also increases the rate of breathing

Emotional factors

Gasping, laughing, crying

## Respiratory influences

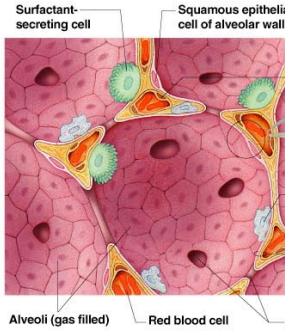
Volition (conscious control)

We can control the rate of breathing to some control (i.e. holding our breath), but respiratory centers will eventually ignore messages from the cortex

Chemicals

Levels of $CO_2$ (medulla) and $O_2$ (carotid body and arch) in the blood affect respiratory rate. Decreased pH.

## Pulmonary surfactants




Essential for proper functioning of the lungs

Lowers surface tension of the film of water lining alveoli, keeping them from collapsing

Not present until babies are 28-30 weeks old