The Respiratory system Cheat Sheet

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Structural zones

upper respiratory tract	lower respiratory tract
- nose	- larynx
- pharynx	- trachea
	- bronchi
	- lungs

Nasal cavities

bony framework

> frontal bone, nasal bones, maxilla

cartilaginous framework

> lateral nasal cartilages, septal cartilage, alar cartilage

nasal cavity

> hollow space behind nose that air flows through

septum

> thin wall made of cartilage/bone, divides inside of nose into two chambers

mucous membrane

> thin tissue lining nose, sinuses & throat, warms & moistens air breathed in & makes sticky mucus that cleans the air of particles/dust

turbinates

> curved, bony ridges lined with mucous membrane - warm & moisten air

sinuses

> hollow, air-filled chambers in bones around your nose - mucus from sinuses drains into nasal cavity

c

- external nose is visible on face
- internal nose is large cavity beyond nasal vestibule, divided by septum into right/left nares

O2 transport

in the blood, some O2 is dissolved in plasma as a gas (about 1.5%)

most O2 (about 98.5%) is carried attached to Hb

oxygenated Hb = oxyhaemoglobin

** the higher the Po2, the more O2 combines with Hb

Volume-pressure relationship - Boyles law

pressure of a gas in a closed container is inversely proportional to the volume of the container

Ventilation-perfusion coupling

blood flow to each area of the lungs matches the extent of airflow to alveoli in that area

in the lungs, **vasoconstriction in response to hypoxia** diverts pulmonary blood from poorly ventilated areas of the lungs to well-ventilated regions

in all other body tissues, **hypoxia causes dilation** of blood vessels to increase blood flow

Alveoli

type I cell

> simple squamous epithelial cells - site of gas exchange

type II cell

> cuboidal epithelial cells, microvilli, secrete surfactant, lowers surface tension

alveolar macrophages

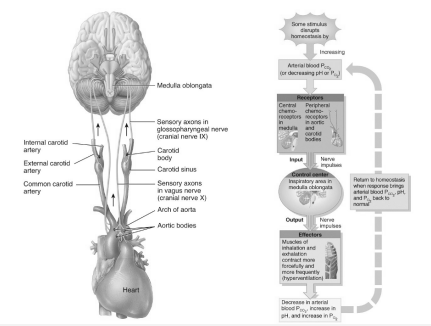
> remove dust

fibroblasts

> reticular/elastic fibers

cup-shaped out-pouchings which participate in gas exchange, alveolar sac comprises two or more alveoli that share a common opening

Control



Respiration

1) pulmonary ventilation

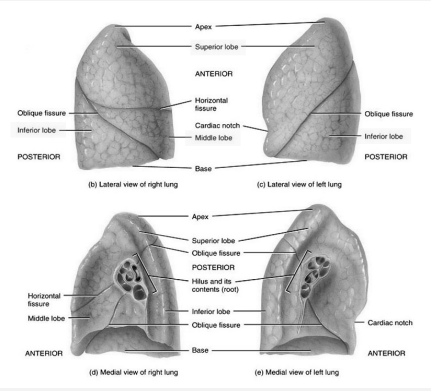
2) external (pulmonary) respiration

3) internal (tissue) respiration

External respiration (pulmonary) is gas exchange between alveoli & blood
Internal respiration (tissue) is gas exchange between systemic capillaries & tissues of the body

the rate of pulmonary & systemic gas exchange depends on...
1. partial pressure difference of the gases
2. SA available for gas exchange
3. diffusion distance
4. molecular weight & solubility of gases

Gross anatomy of lungs



pneumothorax - air
hemothorax - blood/pus

Pulmonary lobule

respiratory bronchioles give way to alveolar ducts & the simple cuboidal epithelium changes to **squamous** which comprises the alveolar ducts, sacs & alveoli.
bronchioles mark the start of the **respiratory zone**

each pulmonary lobule is wrapped in **elastic connective tissue** & contains a lymphatic vessel, an arteriole, a venule & a terminal bronchiole.

Trachea - windpipe

- semi-rigid pipe made of **semi-circular cartilaginous rings**
- located anterior to esophagus
- approx. 12cm - extends from inferior portion of larynx
- divides into **right & left primary bronchi**
- composed of **four layers**:

1. mucosa (mucous-secreting epithelium)
2. submucosa
3. hyaline cartilage
4. adventitia

Functional zones

conducting zone

> involved with bringing air to site of external respiration, consists of nose/pharynx/layrnx/trachea/bronchi/bronchioles/terminal bronchioles.

Functional zones (cont)

respiratory zone

> main site of gas exchange, consists of respiratory bronchioles, alveolar ducts, alveolar sacs, alveoli.

air passing through the respiratory tract transverses the...

1. nasal cavity
2. pharynx
3. larynx
4. trachea
5. primary bronchi
6. secondary bronchi
7. tertiary bronchi
8. bronchioles
9. alveoli (150 million/lung)

CO2 transport

transported in blood in three different forms:

7% = dissolved in plasma (gas)

70% = converted into **carbonic acid** by carbonic anhydrase before dissociated into bicarbonate & protons

23% is attached to Hb forming **carbamino-haemoglobin** (Hb-CO2) but not at same binding sites as oxygen

$CO2 + H2O <---> H2CO3 <---> HCO3^-$
..... CA

Bronchial tree

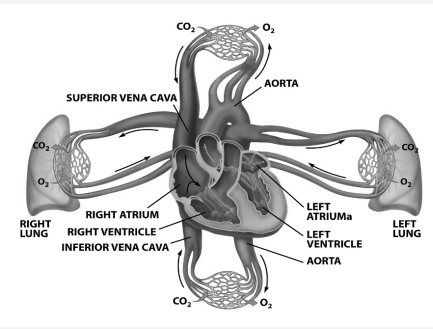
- epithelium
- goblet cells
- ciliated cells
- glands
- hyaline cartilage
- smooth muscle
- elastic fibers

Bronchial tree (cont)

trachea --> primary bronchi --> secondary bronchi --> tertiary bronchi --> bronchioles --> terminal bronchioles

all branches from trachea to terminal bronchioles are **conducting airways** & do not participate in gas exchange.

Pulmonary circulation



lungs receive blood via two sets of arteries:
1. **pulmonary arteries carry deoxygenated** blood from right heart to lungs for oxygenation
2. **bronchial arteries** branch from aorta & **deliver oxygenated** blood to lungs primarily perfusing the muscular walls of the bronchi & bronchioles.

Cilia

cilia in upper respiratory tract move **mucous & trapped particles** down toward pharynx.
cilia in lower respiratory tract move them up toward larynx.

Pulmonary ventilation - breathing

- movement of air between atmosphere & alveoli, consisting of inhalation/exhalation
- changes to intra-thoracic volume allow ventilation to occur

rate of airflow & effort required depend on
1. alveolar surface tension
2. compliance of the lungs
3. airway resistance

Larynx - voice box

composed of **nine pieces of cartilage**, forms a short passageway connecting the **laryng-opharnx** with the trachea

Pharynx

hollow tube that starts posterior to internal nares & descends to opening of larynx in neck, formed by complex arrangement of skeletal muscles that assist in deglutition functions as...
1. passageway
2. resonating chamber
3. housing for tonsils

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