Introduction to Breathing & Ventilation

Pulmonary ventilation

- Inspiration: air flows into lungs
- Expiration: gases exit lungs

Boyle's Law: Pressure of a gas varies inversely with its volume

Change in **volume** of thoracic cavity
→ Change in **pressure** within thoracic cavity
→ **Flow** of gases from atmosphere into lungs (or vice versa)

- Volume change depends on movement of diaphragm & ribs
- Intrapulmonary pressure is always higher than intrapleural pressure

Inspiration

Diaphragm contracts, moves inferiorly & flattens out
External intercostal muscles contracts → Rib cage is elevated; sternum is pulled forward
→ Lungs are stretched
→ Intrapulmonary volume increases
→ Intrapulmonary pressure drops below atmospheric pressure
→ Air flows into lungs down pressure gradient

Expiration

Inspiratory muscles relax & resume resting length
→ Rib cage descends (due to gravity)
→ Volume of thoracic cavity decreases
→ Lungs recoil
→ Intrapulmonary volume decreases
→ Intrapulmonary pressure rises above atmospheric pressure
→ Gases flow out of lungs down pressure gradient

Forced inhalation & expiration: requires contraction of more muscles

Lung volumes

- Tidal volume (TV), Inspiratory reserve volume (IRV), Expiratory reserve volume (ERV), Residual volume (RV)

Lung capacities

- Inspiratory capacity (IC), Functional residual capacity (FRC), Vital capacity (VC), Total lung capacity (TLC)

Dead space

- Volume of inhaled air which does not take part in gas exchange
- Anatomical dead space: volume of conducting respiratory passageways
- Alveolar dead space: volume occupied by alveoli that cease to act in gas exchange
- Increase in certain lung diseases

Non-respiratory air movements: e.g. coughing, sneezing, crying, laughing, yawning

Composition of alveolar gas: more carbon dioxide & water vapor