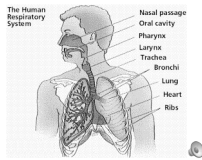


Respiratory System

Section 37-3



Respiration

- Cellular Respiration
 - Mitochondria
 - Release energy from food in the presence of oxygen
 - ATP production
- Gas Exchange
 - Blood carries oxygen to cells
 - Blood carries carbon dioxide to lungs

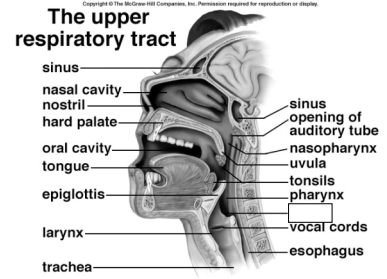
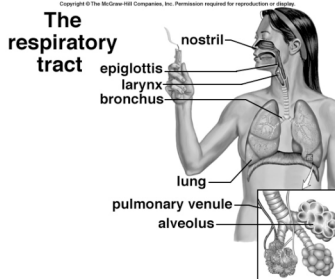
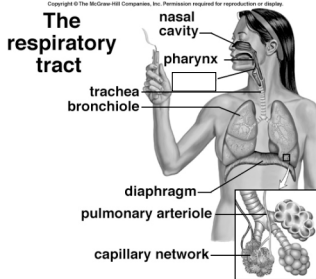


Functions



Works closely with circulatory system to exchange gases between air, blood, and tissues:

- Takes up oxygen from air and supplies it to blood
- Removal and disposal of carbon dioxide



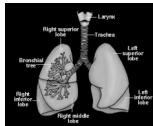
Pathway of Inhaled Air

Nasal cavity, throat (pharynx), larynx (voice box), trachea, bronchi, alveoli, and lungs.

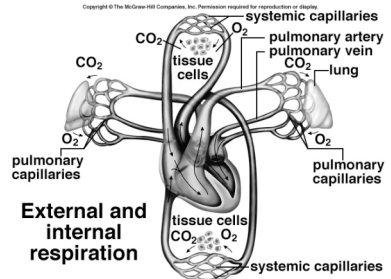
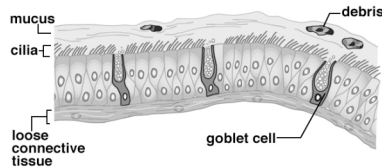
Pathway of Inhaled Air:

- ◆ Nasal cavity
- ◆ Pharynx (Throat)
- ◆ Larynx (Voice Box)
- ◆ Trachea (Windpipe)
- ◆ Bronchi
- ◆ Bronchioles
- ◆ Alveoli (Site of gas exchange) - 150 million/lung

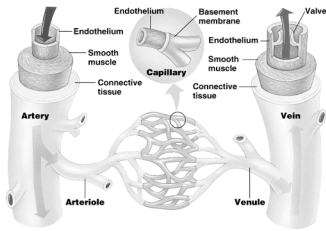
Exhaled air follows reverse pathway



Trachea Cross Section

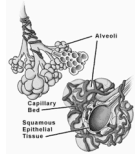


Organization of Blood Vessels

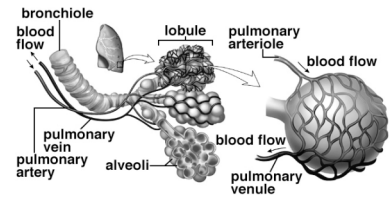


Gas Exchange

- At alveoli level...
- Oxygen diffuses across capillaries covering alveoli
- Carbon dioxide diffuses in opposite direction
- Lungs remove 25% of the oxygen you inhale



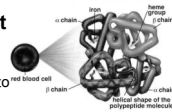
Gas exchange in lungs



Blood supply of alveoli

Capillary network of one alveolus

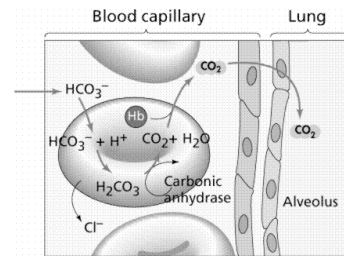
Oxygen Transport



- 98% carried bound to Hemoglobin in rbc
- 2% dissolved in plasma
- Each Fe can bind 1 oxygen molecule
- When oxygen dissolves in blood, it combines with Hb to make oxyhemoglobin
- Oxygen released at tissue level

Carbon Dioxide Transport

- Carbon Dioxide Transport
 - Carbon dioxide diffuses into blood
 - Transported as:
 - 1) Dissolved in plasma
 - 2) Part of Hb (carbaminohemoglobin - 15%)
 - 3) Bicarbonate ion
 - Carbon dioxide + water = carbonic acid (uses carbonic anhydrase to speed up reaction)
 - carbonic acid dissociates into hydrogen ion and bicarbonate
 - hydrogen ion combines with Hb
 - Bicarbonate diffuses out of rbc into plasma
 - 70% carried in this form



Why Breathe?

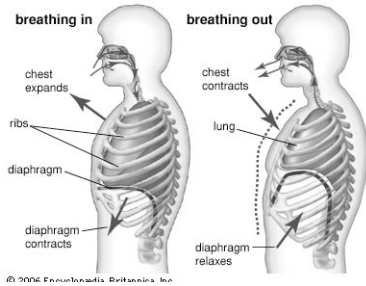
- Ventilation: movement in/out
- External Respiration: lungs & blood
 - Transport of gases in blood
- Internal Respiration: blood & body cells
 - Oxygen utilization & carbon dioxide production: cell respiration
- LUNGS
 - 3 lobes right
 - 2 lobes left
 - Thoracic cavity

How Do we Breathe?

- Inspiration: inhalation; air into lungs
 - Chest expands
 - Diaphragm contracts and falls
 - Intercostals contract
 - Abdominal wall relaxes
 - Volume increases
 - Lungs expand
 - Air moves in because greater pressure outside than inside lungs

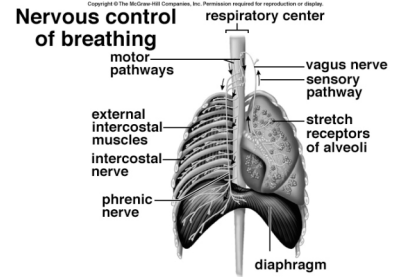
Breathing continued...

- Expiration = Exhalation; expelling air from lungs
 - Chest gets smaller
 - Diaphragm relaxes
 - Intercostals relax
 - Abdominal wall contracts
 - Volume decreases
 - Air is forced out



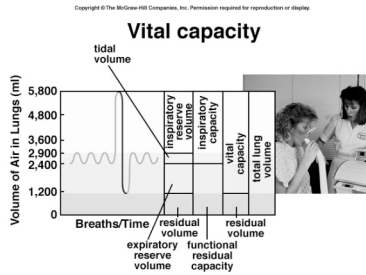
Control of Breathing

- Medulla oblongata controls breathing
- Autonomic nerves lead to the diaphragm and chest muscles
- The medulla oblongata monitors carbon dioxide in the blood
- Too much - diaphragm contracts

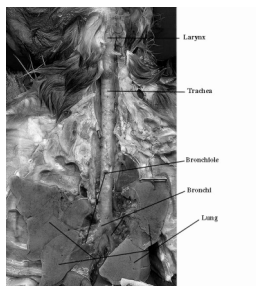
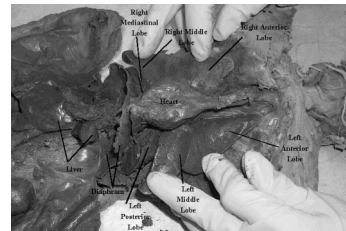


Respiratory Volumes and Capacities

- **Spirometry** = measure of air volumes
- **Respiratory Cycle**: one inhalation and one exhalation
- **Tidal Volume**: amount of air that enters OR leaves the lung (500 mL)
- **Inspiratory Reserve**: During forced inspiration, quantity of air in addition to tidal volume entering lungs (3000 mL)
- **Expiratory Reserve**: supplemental air; max forced out (1100 mL) after an ordinary expiration
- **Residual Volume**: always remains even after forced expiration (1200 mL)
- **Vital Capacity**: max air exhaled after deepest breath (4600 mL)
- **Total Lung Capacity**: Vital + Residual (5800 mL)



Cat Respiratory System I



Cat Respiratory System II