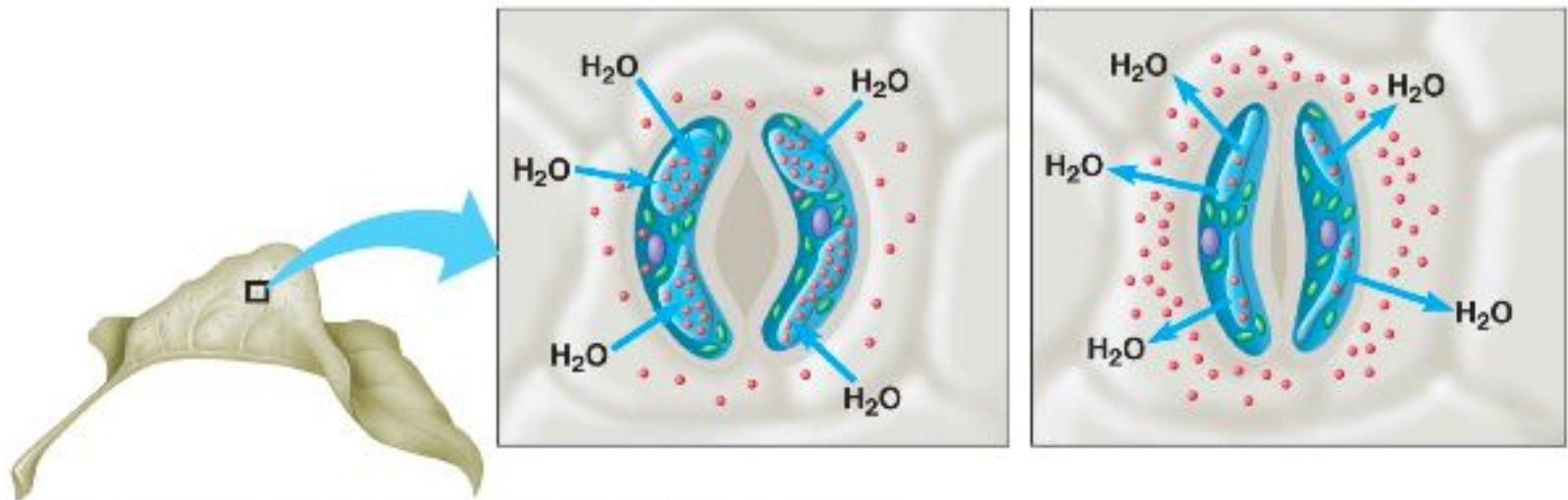


Respiration in Plants and Animals

Bio 11

Respiration in Plants

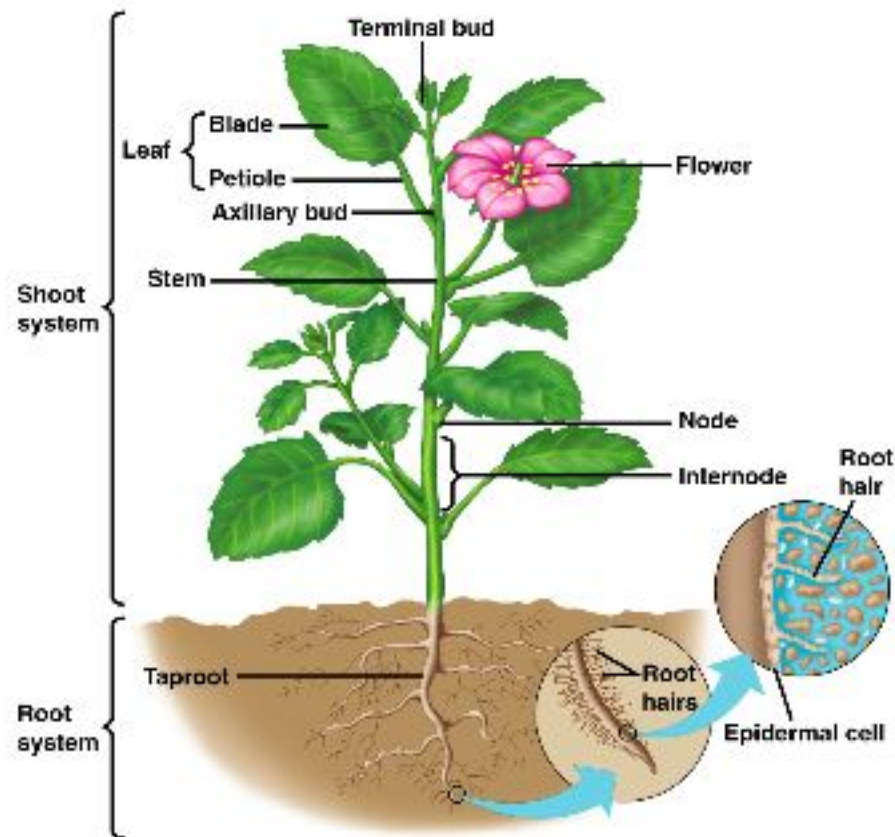


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Respiration in Plants

- Gas exchange is essential for photosynthesis
- The plant organ that is involved in this process is the leaf.

Anatomy of the leaf



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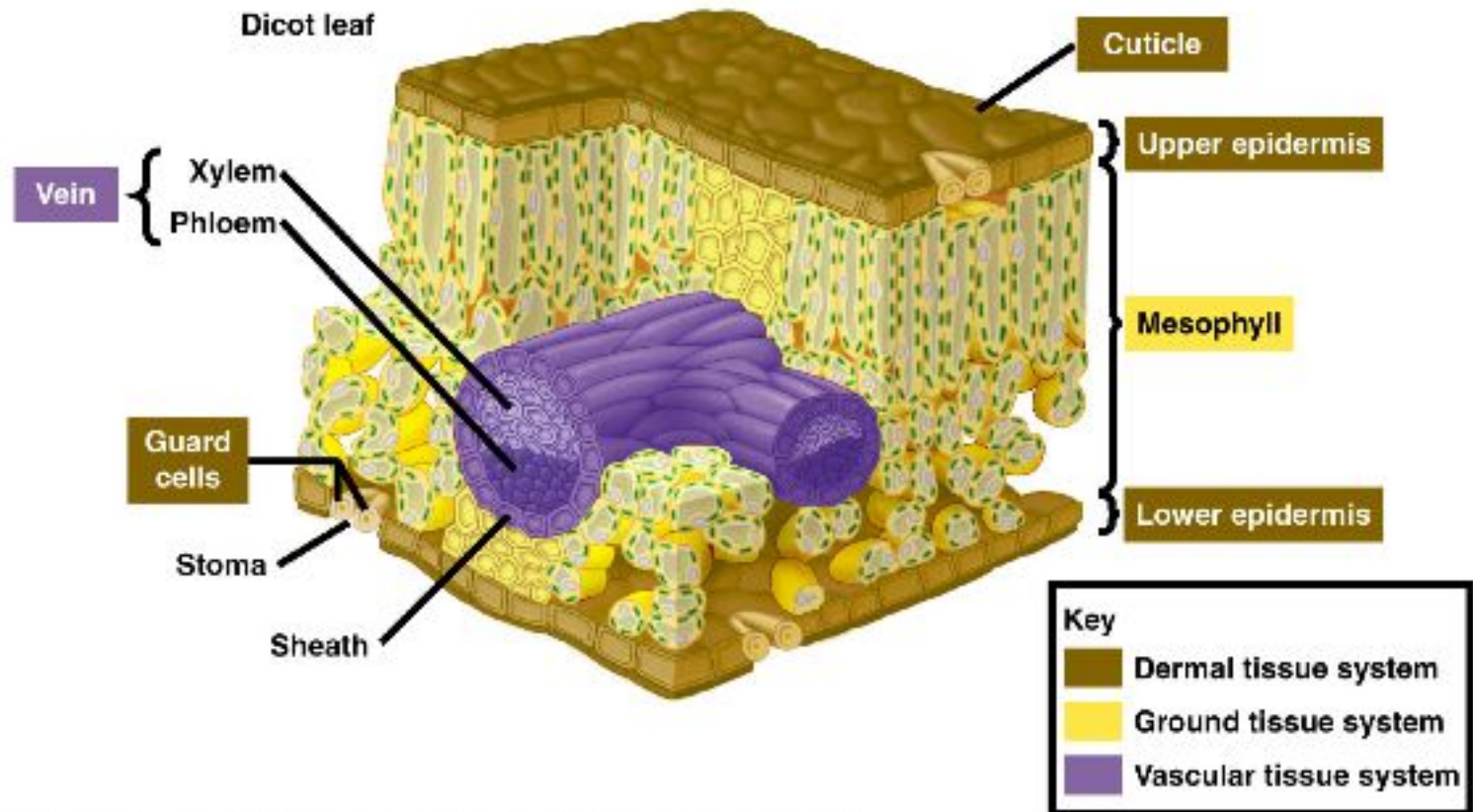
Anatomy of the leaf

- Blade- flat portion of the leaf
- Petiole - connects the leaf to the stem
- Inside the petiole are the xylem and phloem of the plant.
- Xylem moves water in the plant
- Phloem moves sugars.
- Veins in a leaf are the vascular bundles of xylem and phloem.

Leaf has two goals

- To not be a major source of water loss. Therefore it is covered with a waxy cuticle
- Gas exchange -- therefore we have the presence of stomata.

Anatomy of the leaf



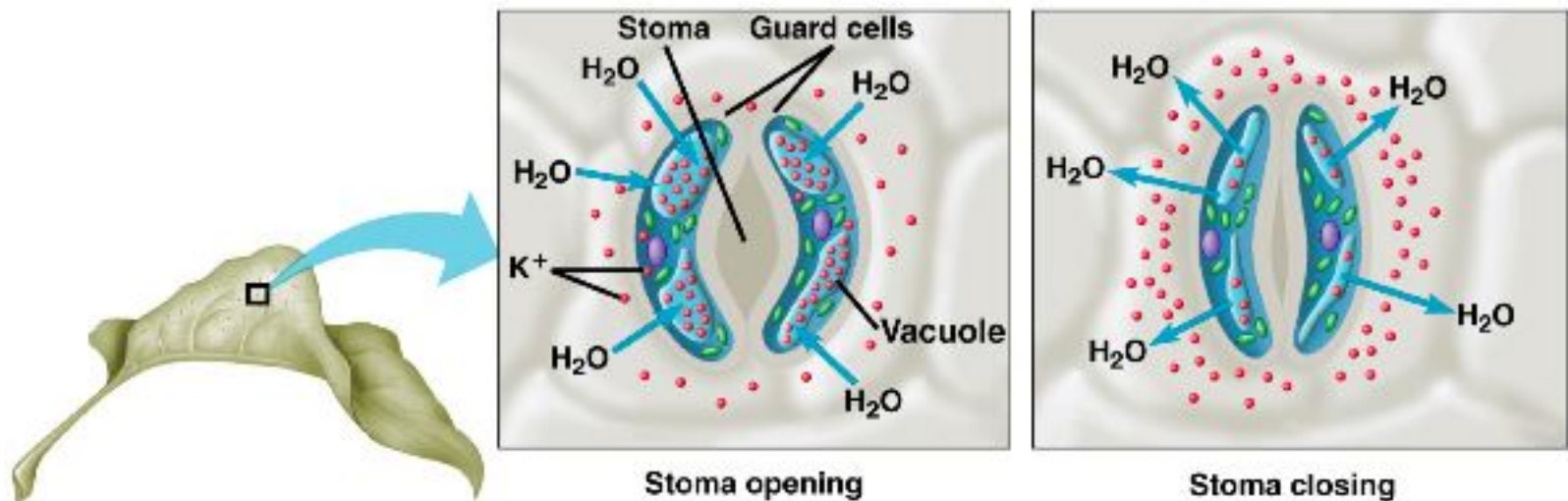
Anatomy of the leaf

- Cuticle -- waxy protection
- Epidermis -- outer layer of cells
- Mesophyll -- where the photosynthesis takes place.
- Vein -- xylem and phloem
- Stoma -- opening for respiration
- Guard cells -- regulate that opening.

How stomata function

- Stomata open during the day when photosynthesis is active and closed at night
- During dry times they can also be closed
- When water is present the guard cells around the stomata swell the stomata opens.
- When the plant does not have an abundance of water the guard cells deflate and the stomata close

How stomata function



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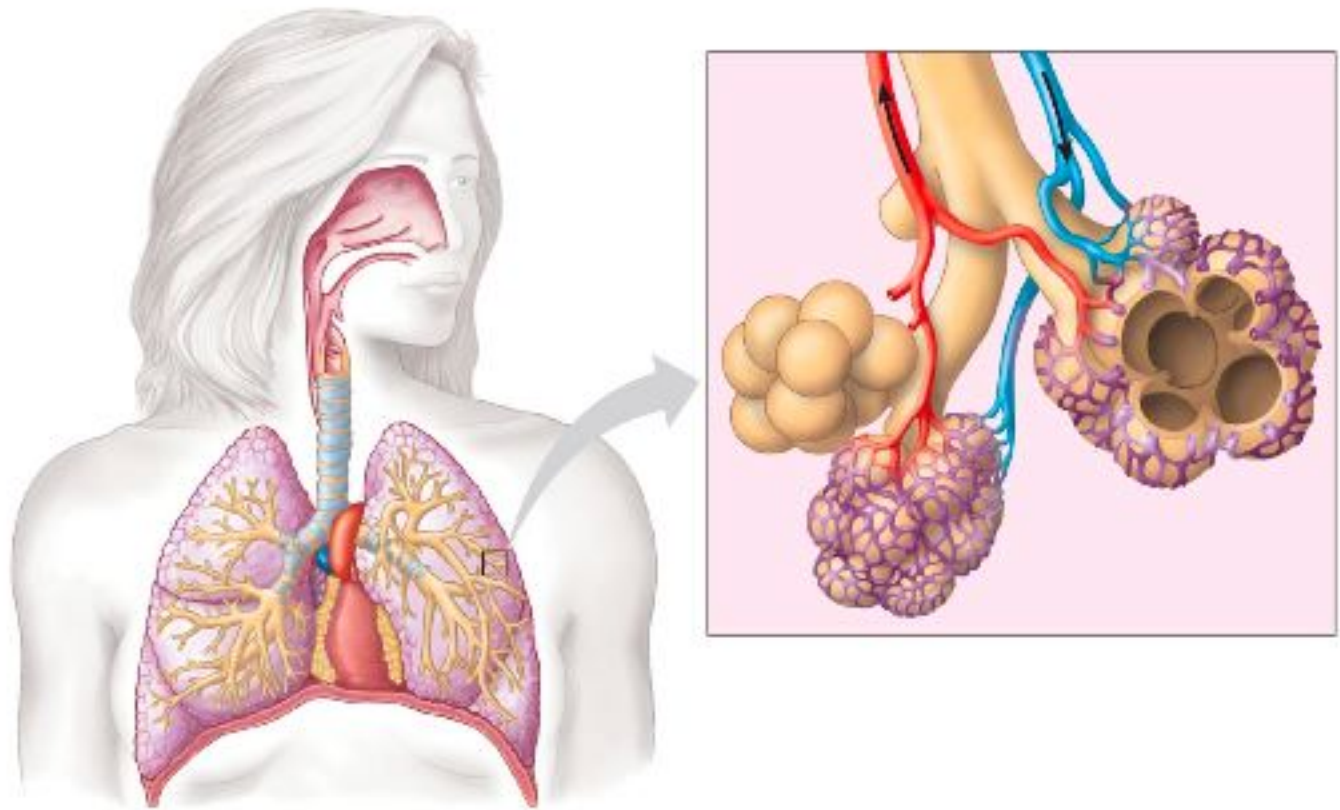
How stomata function

- When light strikes certain pigments in the guard cells their potassium pumps are activated.
- Potassium is pumped into the guard cells.
- As the potassium levels go up in the cells so does the amount of water.
- The cells swell and they open.
- To close - the guard cells are in a dehydrated condition.

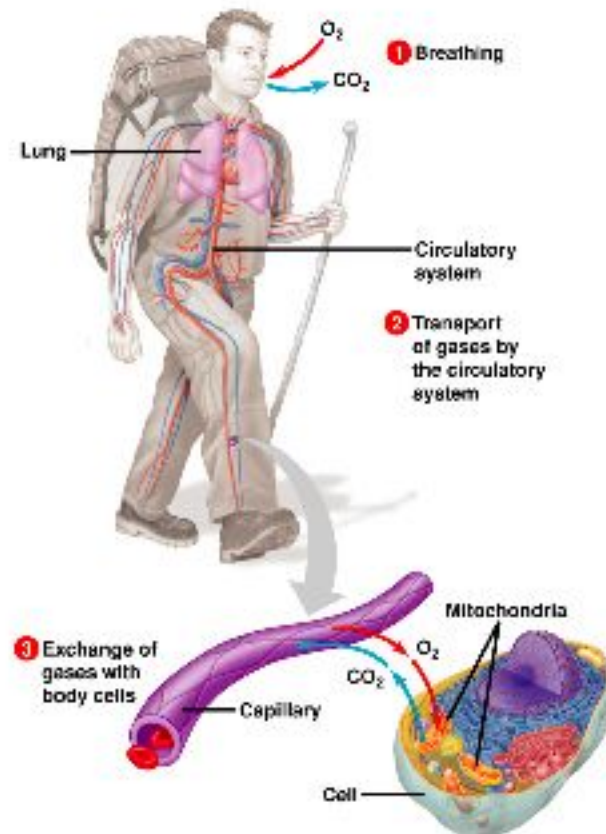
How stomata function

- Other ways they can be activated
- When the concentration of Carbon dioxide is too low -- guard cells have chloroplasts.
- Abscissic acid -- when the xylem can not keep up with the loss of water through the leaf. Leaf begins to wilt produces this hormone and the stomata close.

Respiration in Animals



Basic gas exchange



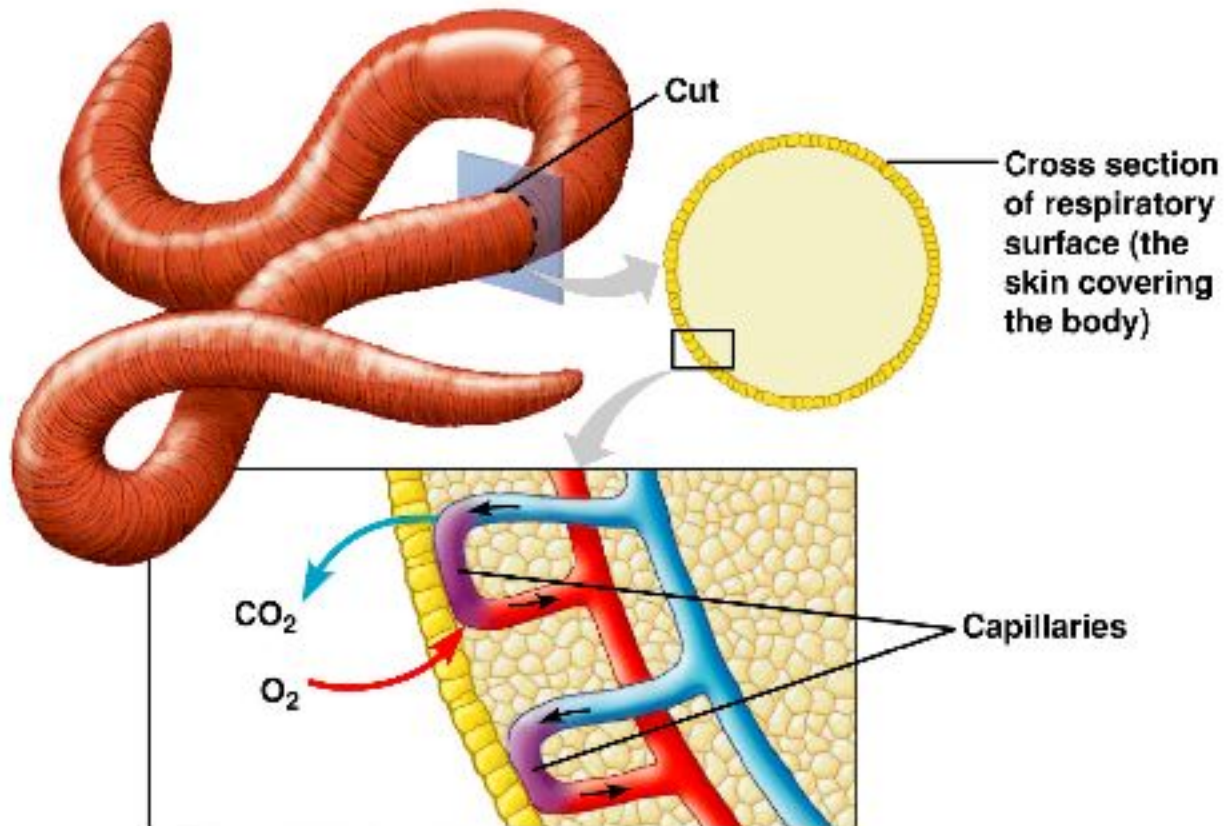
Gas exchange

- 1) surface through which the gas exchange will occur must be moist - respiratory surface.
- 2) The larger the surface area the greater the efficiency-- skin is used as the respiratory organ in some species.
- 3) Gas exchange is by diffusion whether it is a sponge or a human.
- 4) The circulatory system is in close association with the respiratory system.

Gas exchange

- Oxygen is either already dissolved in water or dissolves in the water at the respiratory surface.
- Oxygen moves into the circulatory system by diffusion
- Moves through the circulatory system.
- Gasses are exchanged at the tissue again by diffusion.

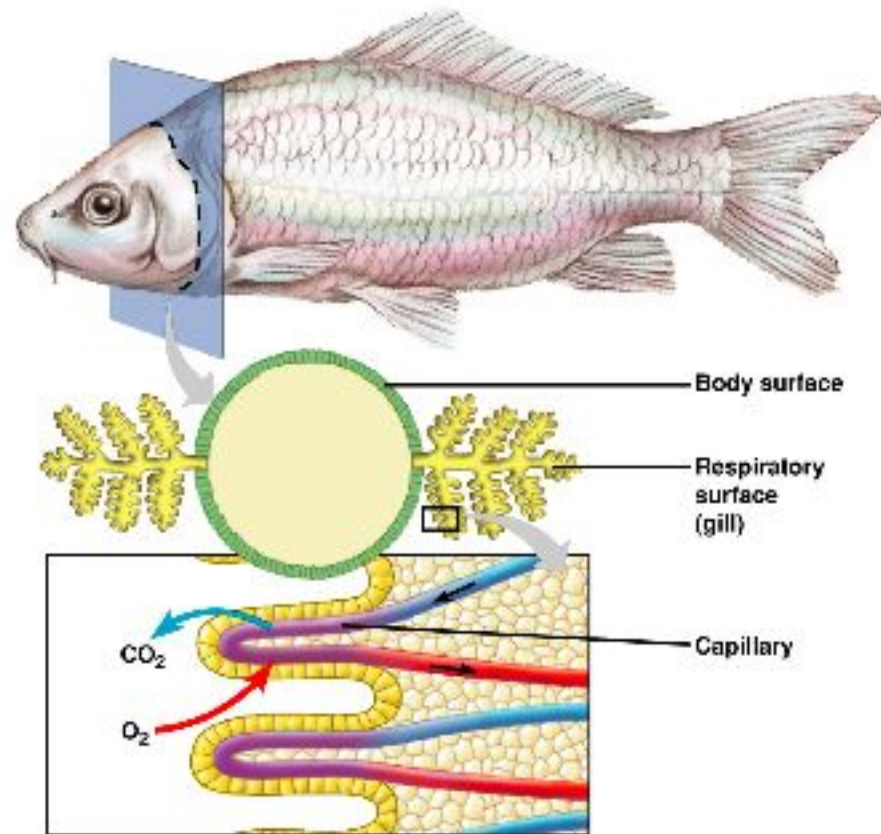
Earthworm respiration



Earthworm respiration

- Skin is the respiratory organ.
- See a close association of the circulatory system with the respiratory system.
- Site where oxygen enters and carbon dioxide leaves.

Respiration in fish

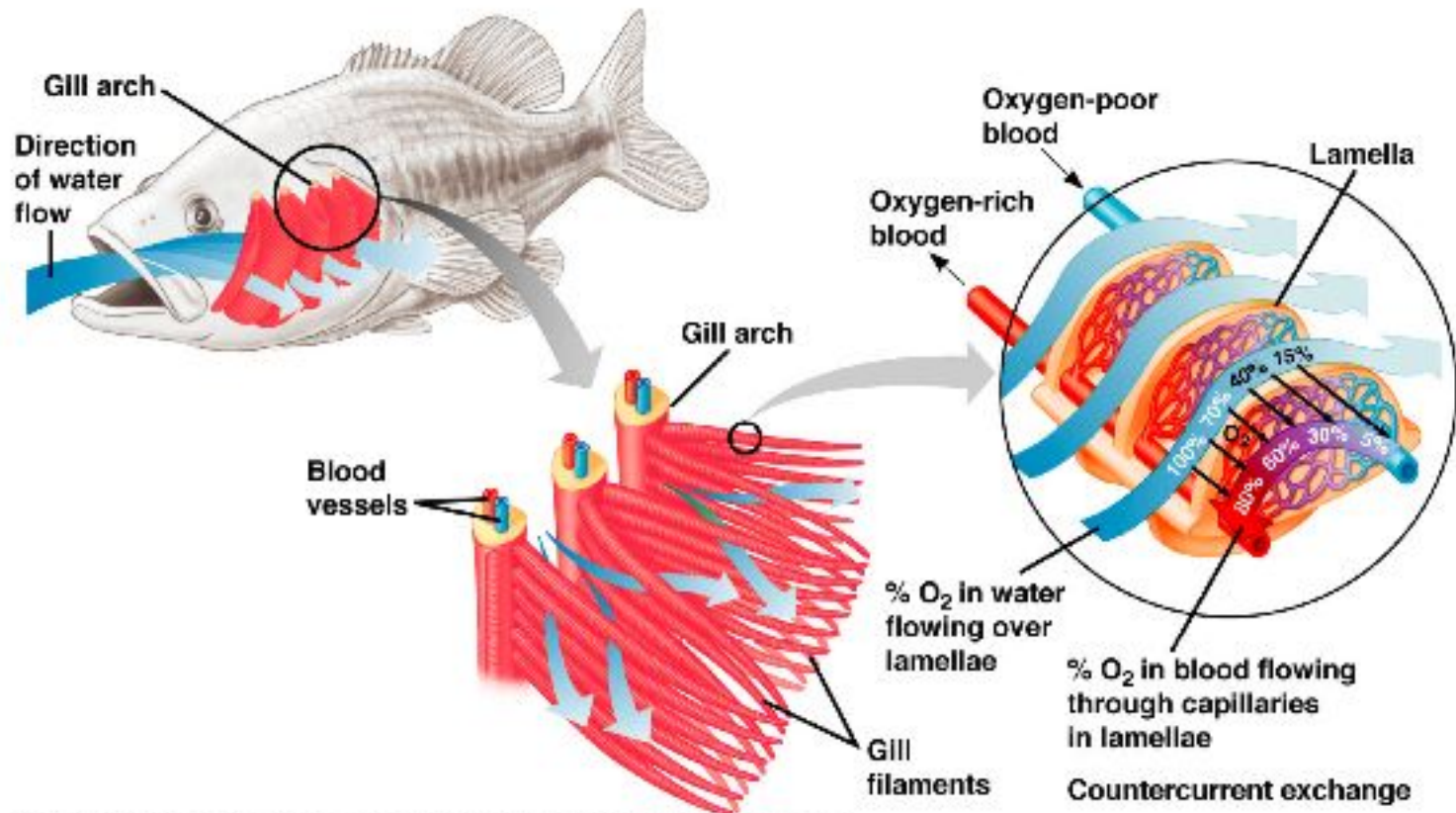


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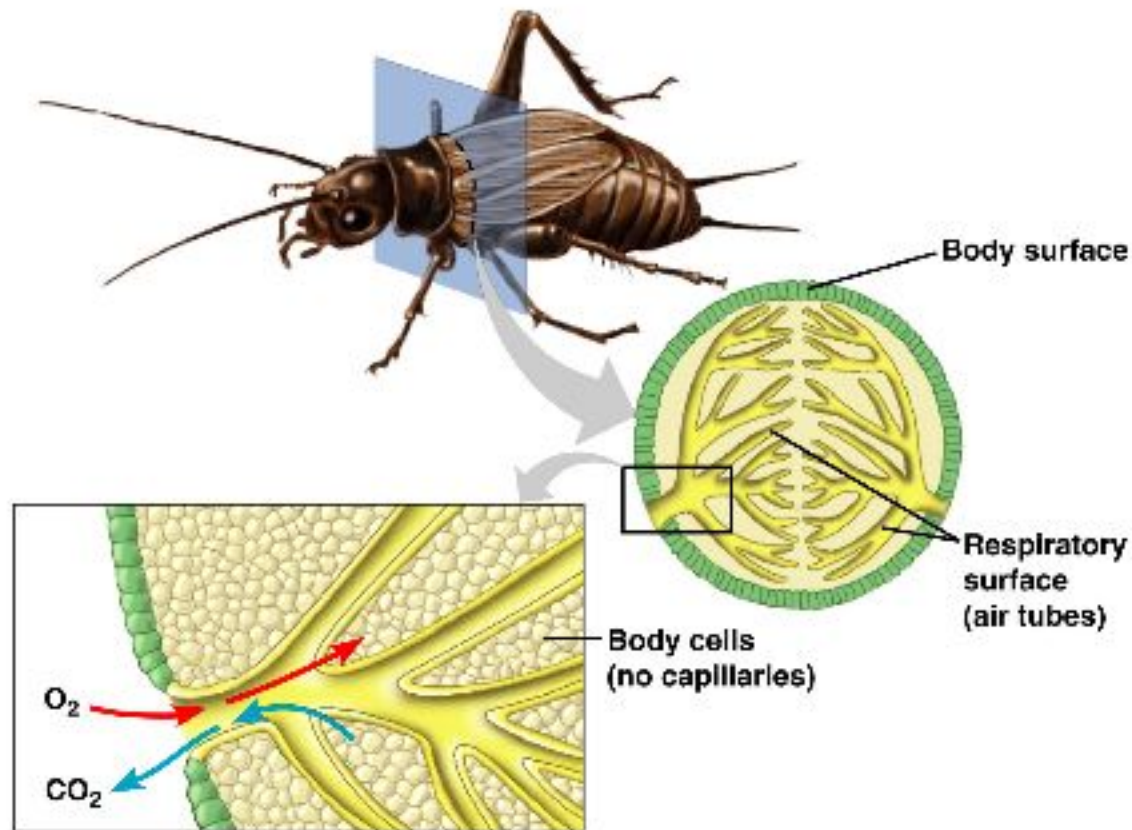
Respiration in fish

- Obtain their oxygen from the gills
- The gills are highly folded (increase surface area) and protected by the operculum.
- The fish open their mouth and pump water over the gills by ejecting out the operculum.
- Fish that live in more stagnant water have larger gill surface areas.

Respiration in fish



Respiration in beetles

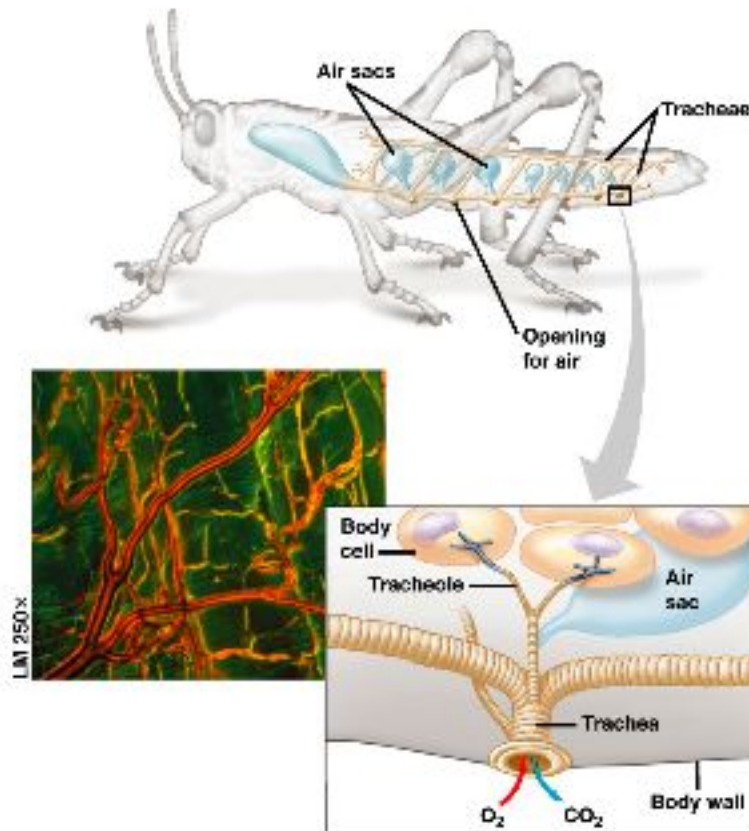


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Respiration in beetles

- Respiration in through tracheae
- These are reinforced with chitin
- Branch into tracheoles--this part of the digestive system is not reinforced with chitin.
- Air enters through the spiracles which are along the abdomen of the beetle.
- The insects use the contraction of their muscles to suck in the air.

Respiration in beetles



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Respiration in beetles

- Closed tubes have water at the end.
- Very efficient delivery of oxygen to the muscles and the tissues that need it.

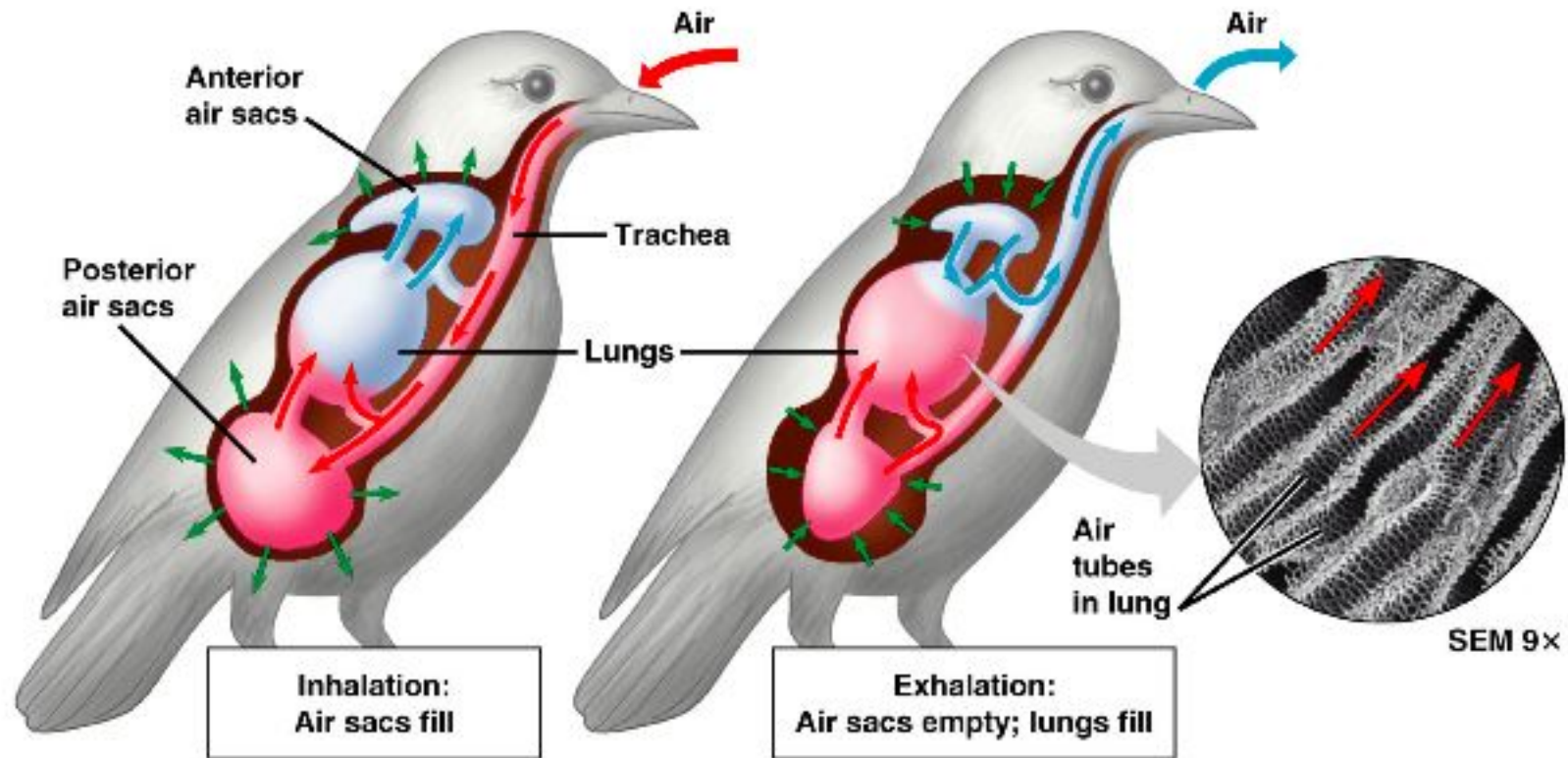
Respiration in Amphibians

- They use very simple lungs.
- Also have to use their skin surface as an additional respiratory organ.

Respiration in reptiles

- See a lung with a much larger surfaces area. Very highly folded.
- No longer use their skin as a respiratory organ.

Respiration in birds



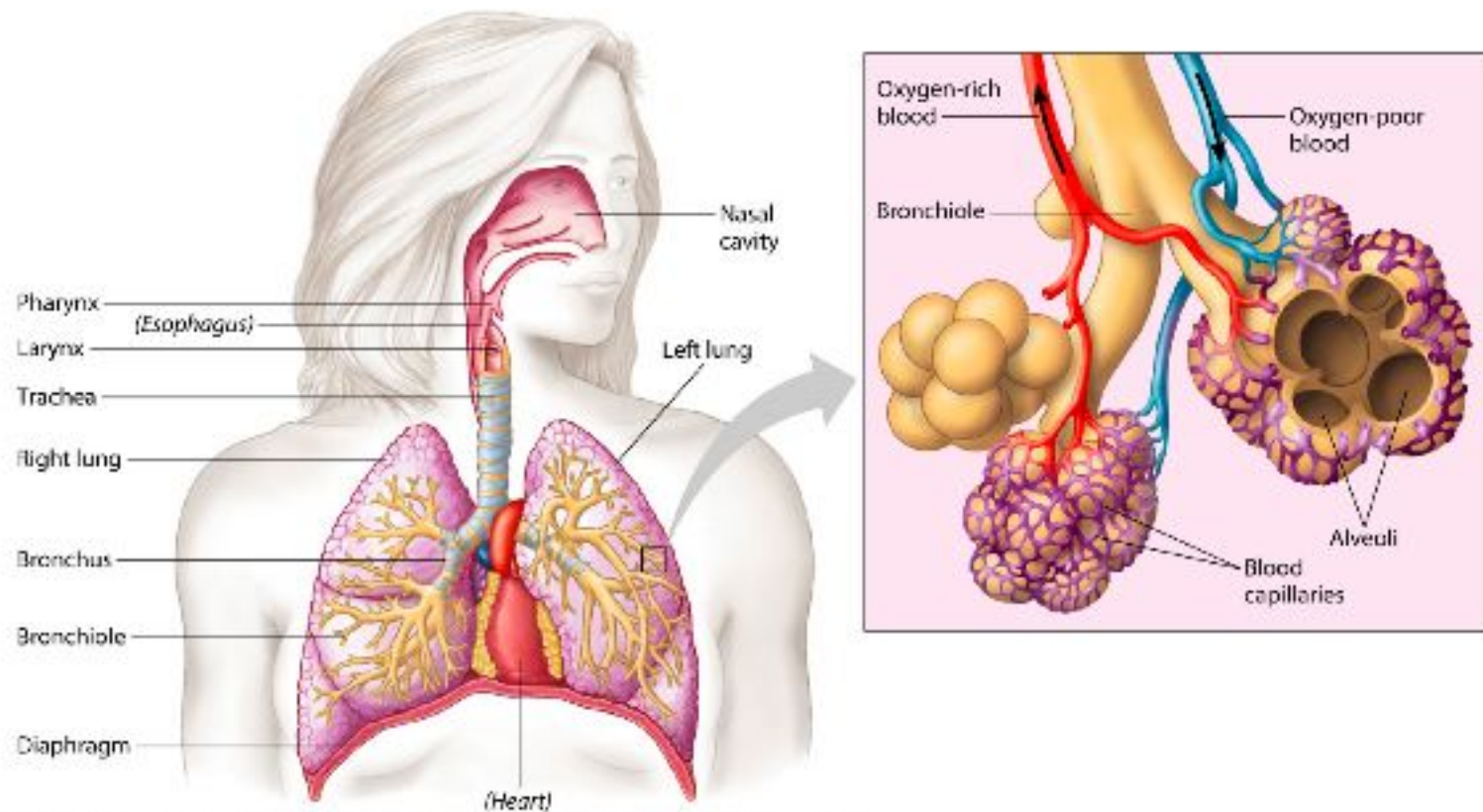
Respiration in birds

- Respiration is in a one way flow.
- Much more efficient lung can get 5% more oxygen out of their breathes than humans can.

Human respiratory system

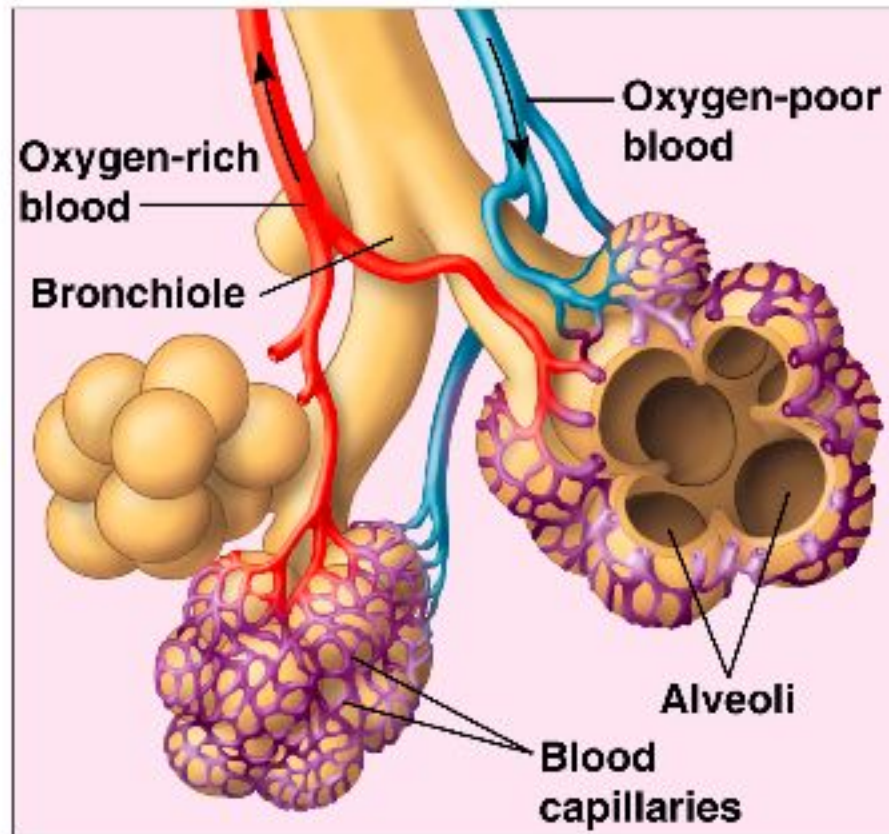
- The conducting system - brings air into the lungs
- The gas exchange system - the gas exchange with the circulatory system.

Respiratory system



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Gas exchange system



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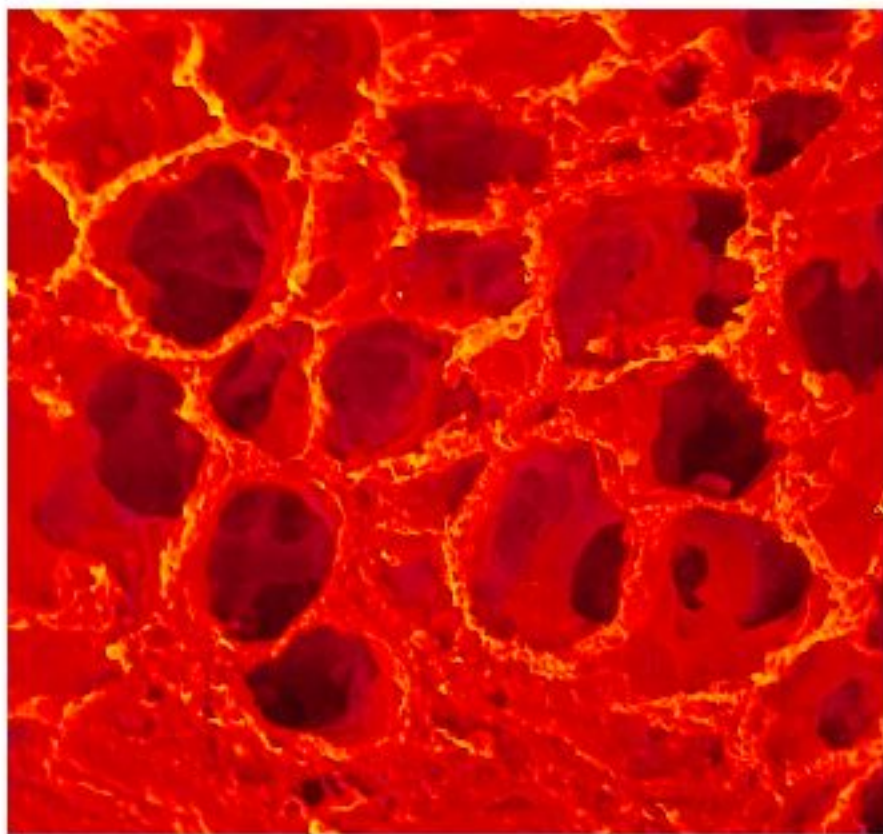
Protection of the lungs

- Nasal area and trachea filter the area.
- Mucus collects debris including invading viruses.
- Cilia move this up to the pharynx area where it moves down the esophagus and destroyed by stomach juices.

Increasing surface area

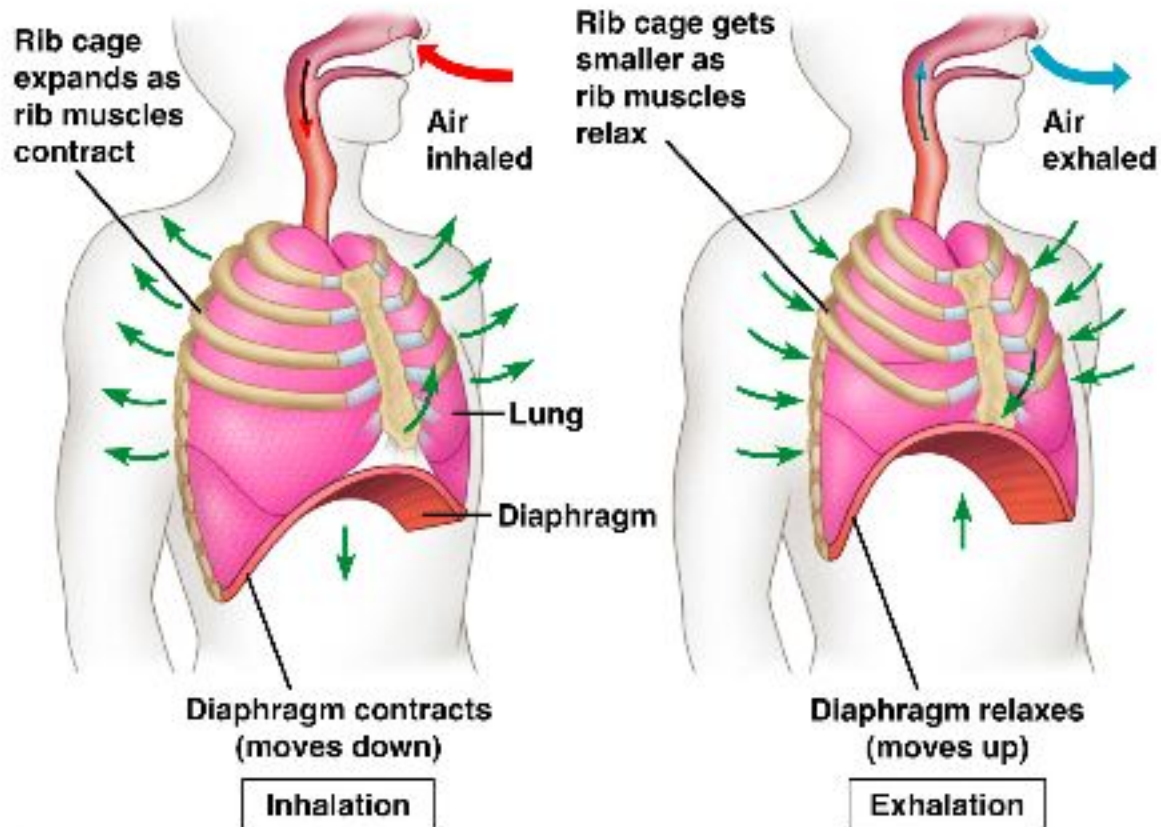
- This is through the continual branching- trachea - bronchi - bronchioles - alveoli
- Due to the presence of alveoli your lung surface area is around 75 sq. meters. This is 80 times the surface area of your skin.
- The alveoli are only one cell thick and so are the capillaries that surround the alveoli. This greatly aids diffusion.

Increasing surface area



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Breathing



Breathing

- Alternation between inhalation and exhalation.
- Diaphragm contracts - increases size of chest cavity causing a vacuum - Air rushes in.
- Diaphragm relaxes decreases size of chest cavity - Air is pushed out.
- Termed negative pressure breathing

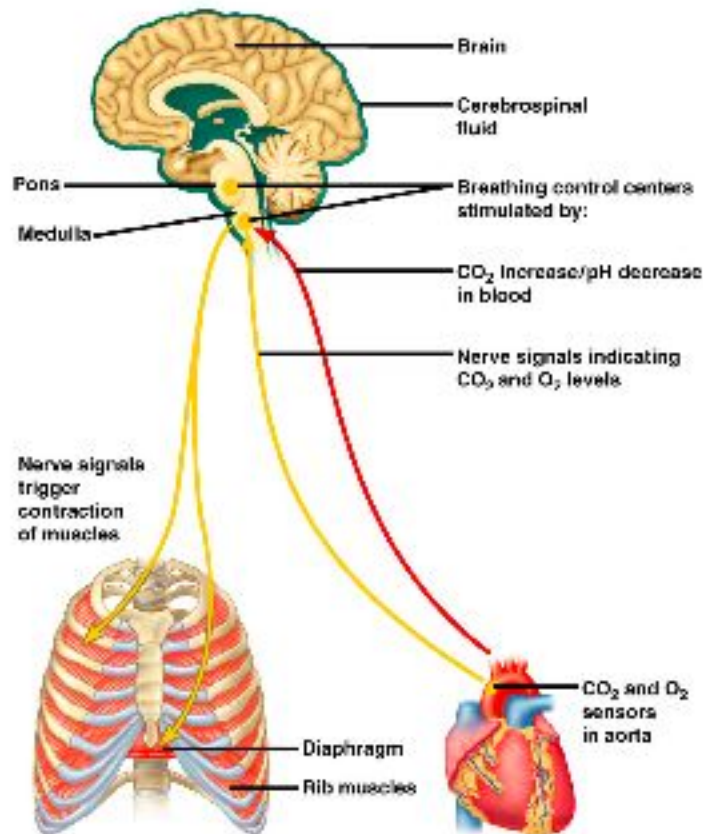
Positive pressure breathing

- Seen in frogs.
- Force air from their mouths into their thorax cavity.

Breathing control centers

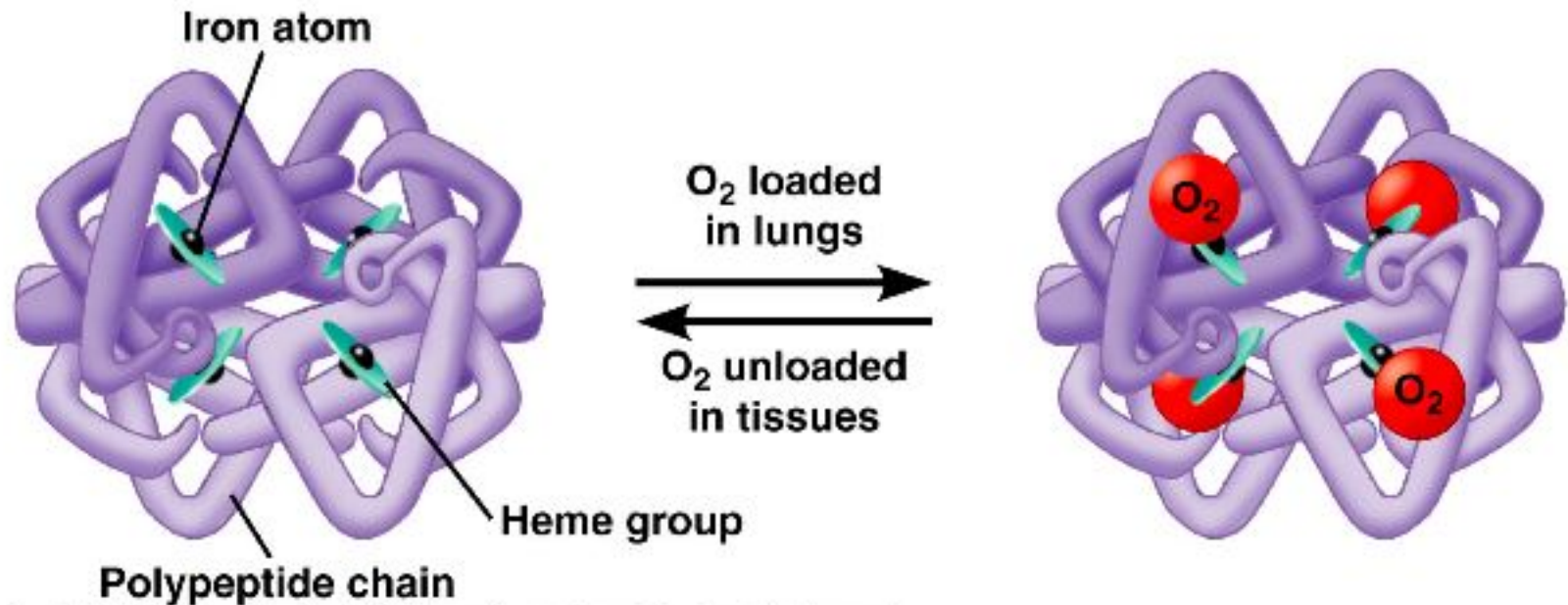
- Medulla oblongata- monitors carbon dioxide levels
- Also have sensors for this near the heart.
- Carbon dioxide levels are monitored via pH.

Breathing control centers



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How the oxygen is delivered



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Hemoglobin

- Four polypeptide chains.
- Each chain has a heme group.
- In the center of the heme group is iron.
- Binds through cooperative binding/
- When binding oxygen it lowers the actually concentration of oxygen in the area next to the lungs.

Hemoglobin

- Allows blood to carry 70 times more oxygen than it can without it.
- Also the heme group will bind carbon monoxide tightly this can cause problems.

Carbon dioxide transportation in blood

- 20% of the carbon dioxide that is picked up by blood binds to hemoglobin
- 10% of it is dissolved in the plasma
- While 70% is transported as bicarbonate (HCO_3^-).
- Conversion of carbon dioxide is helped by the enzyme carbonic anhydrase.

Bicarbonate formation

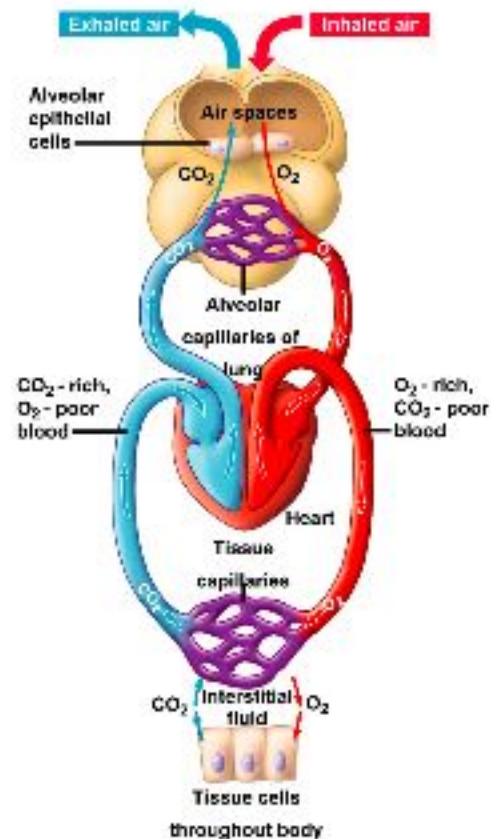


Effects the pH of the blood. More CO_2
the more acidic the blood in that region.

Hemoglobin unloading

- Effected by pH -- more acidic regions will cause hemoglobin to off load its oxygen.

How the oxygen is delivered

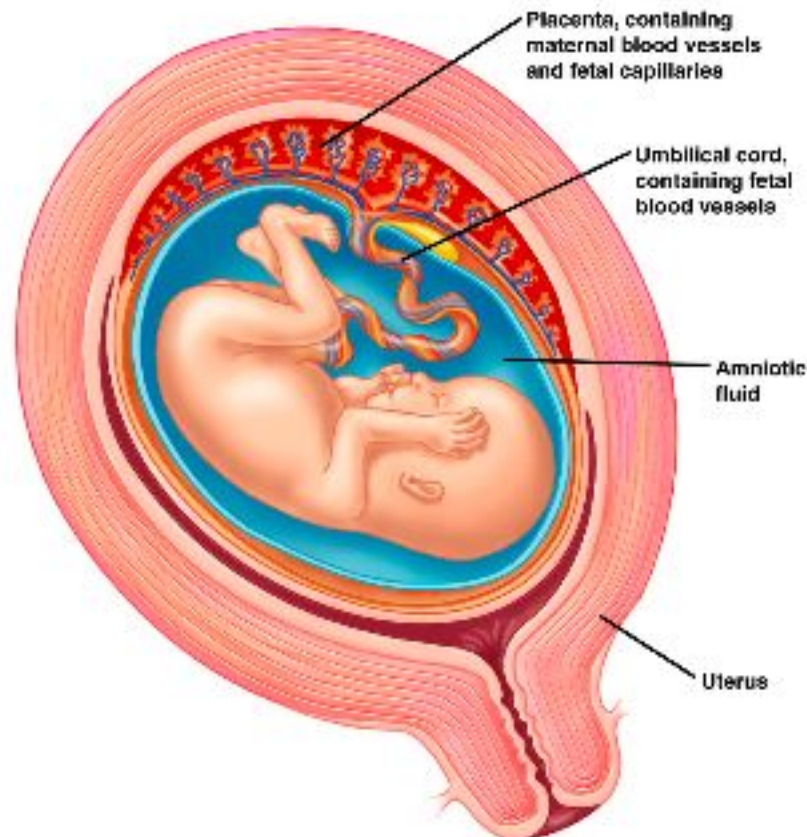


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How the oxygen is delivered

- Oxygen is loaded at the lungs and carbon dioxide leaves the blood.
- Near the active muscles bicarbonate levels are high and pH is low -- so oxygen is dumped off of the hemoglobin.

How babies get their oxygen



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How babies get their oxygen

- Oxygen exchange is through the placenta.
- Fetal hemoglobin has a greater affinity for oxygen than adult hemoglobin.
- When the baby is born there is an increase in the carbon dioxide levels due to not breathing. This will trigger the first breath.