Chapter 13
Respiration & Excretion

Breathing - Did you know?

Lungs are very spongy and elastic because of the millions of air sacs

Lungs exchange about 10,000 L of air a day.

Lungs would float like corks in water
They test whether or not a person had drowned by seeing if part of their lung sinks. If it does a person has died from drowning.
13.1 - The Role of Respiration

Breathing and Respiration are very different!!

• **Breathing** is the process that forces air into and out of the lungs.
• **Respiration** is the chemical process that occurs within all cells.

• The respiratory system
  1) brings $O_2$ into your body
  2) carries $CO_2$ out of your body
• Oxygen combines with sugar to produce energy, carbon dioxide (waste gas) and water.

Breathing
13.2 - Human Respiratory System

**Nose**
- Hairs filter out dust particles from air to prevent from entering the lungs
- Mucus is produced to keep air moist

**Nasal Chamber**
- Above roof of the mouth
- Warms/cools air

**Windpipe (Trachea ~ 15 cm long)**
- Carries air to two shorter tubes that lead to the lungs
- Epiglottis covers it when swallowing

**Bronchi**
- Branches to the left and right lung

**Lungs**
- Site where oxygen and carbon dioxide are exchanged

**Alveoli (~ 30 million in each lung)**
- Tiny air sacs in the lungs that contain capillaries
- Oxygen diffuses into blood to be carried to all parts of the body
- Carbon dioxide moves out of the blood into alveoli then to the lungs and breathed out.
- If alveoli were opened up and spread out they would cover 1/5 of a basketball court (70 m²)
- Very large surface area for gas exchange
http://www.youtube.com/watch?v=qGiPZf7njqY
Gas Exchange

- blood in capillaries around alveoli is low in $\text{O}_2$
- $\text{O}_2$ diffuses out of air sac into blood
- RBC carry $\text{O}_2$ to all body cells and $\text{O}_2$ diffuses into cells
- $\text{CO}_2$ is a waste formed during cellular respiration
- $\text{CO}_2$ diffuses from body cells into capillaries and travels back to lungs
GASES ENTERING LUNGS LEAVING LUNGS

<table>
<thead>
<tr>
<th></th>
<th>ENTERING</th>
<th>LEAVING</th>
</tr>
</thead>
<tbody>
<tr>
<td>Oxygen</td>
<td>19.97%</td>
<td>16.00%</td>
</tr>
<tr>
<td>Carbon Dioxide</td>
<td>0.03%</td>
<td>4.00%</td>
</tr>
<tr>
<td>Nitrogen</td>
<td>80.00%</td>
<td>80.00%</td>
</tr>
</tbody>
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Why does less oxygen move out of the lungs?
Why is more carbon dioxide given off than taken in by the lungs?
Why is nitrogen the same going in and out?


Breathing

• 12-16 x/minute
• unconscious/involuntary
• your rib cage and diaphragm (muscle) help you breathe

Lung Function Review.wmv
Breathing

Inhalation (Breath In)
*Diaphragm (sheetlike muscle that separates the inside of your chest from the organs of the abdomen) moves down.
*Rib cage moves up and out
*Space within chest becomes large
*Air sacs expand as they fill

Exhalation (Breath Out)
*Diaphragm moves up
*Rib cage moves down and in
*Space within chest becomes small
*Air sacs empty as they are squeezed

http://www.youtube.com/watch?v=AO_yy9Ldm7M
Diseases and Disorders

- bronchitis
- asthma
- emphysema
- cystic fibrosis
- tuberculosis
- pneumonia
- lung cancer

* Chronic Bronchitis
- persistent
- increased secretion of mucus.
- the air passages become clogged with mucus, leading to a persistent cough.
- usually associated with cigarette smoking.

* Acute Bronchitis
- results from a virus or bacterial infection
- lasts 2-7 days

straw experiment
*Asthma*
- Constriction of the bronchi and bronchioles makes it more difficult to breathe in and, especially, out.
- Attacks can be triggered by airborne irritants such as chemical fumes and cigarette smoke airborne particles to which the patient is allergic.

[Image of normal and asthma airways](http://kidshealth.org/kid/health_problems/allergy/asthma.html)

*Emphysema*
- Walls of the alveoli break down, reducing the gas exchange area of the lungs.
- Heart must pump even-larger volumes of blood to the lungs in order to satisfy the body's needs for oxygen.
* **Cystic fibrosis**
  - genetic disorder
  - lungs produce lots of a heavy mucus that plugs the airways interfering with breathing and causing a persistent cough.

* **Tuberculosis** (often called TB)
  - Disease that usually attacks the lungs, but can attack almost any part of the body.
  - Spread from person to person through the air.
  - Bacterial infection

* **Pneumonia**
  - Infection of the alveoli.
  - Caused by many kinds of bacteria and viruses.
  - Tissue + fluids accumulate in the alveoli reducing the surface area exposed to air.
*Lung Cancer*
- an uncontrolled reproduction of cells.
- the most common (and most rapidly increasing) types are those involving the cells lining the bronchi and bronchioles.
- the ciliated and mucus-secreting cells disappear and are replaced by a disorganized mass of cells with abnormal nuclei.
- If the process continues, the growing mass penetrates the underlying membrane.

#1 Cause of Lung Cancer/Emphysema/Chronic Bronchitus/Asthma (adults):

"...talking about the danger of cigarette smoke is like talking about the danger of swimming in a shark cage with a bloody nose; it's obvious."  - Dr. Oz

Fact - Spending just one hour in the presence of secondhand smoke is the equivalent of smoking 4 cigarettes.
What does smoking do to your lungs?

1. Destroys cilia (tiny hairs that sweep away dust etc.)
   - Tar sticks to cilia allowing dirt-filled mucus to slide down your lungs and blocks the tiny airways
   - Smokers cough to get rid of dirt particles

2. Enlarges mucous producing cells
   - Mucous increases and thickens
   - Lungs and airways then get irritated and inflames, narrowing and reducing the airflow.

3. Causes serious changes in lungs
   - damage results in less oxygen to body
   - minor changes lead to pneumonia, colds
   - major changes lead to cancer, emphysema, bronchitis
Buerger's Disease - the veins and arteries become inflamed and blocked by blood clots causing parts of the body to die

13.4 - The Role of Excretion

- also needed to maintain homeostasis

What is excretion?
- getting rid of wastes
- solid waste - digestive system
- liquid waste - excretory system
- gas waste - respiratory system

Wastes
- \( \text{CO}_2 \) is removed by the __________
- other wastes by the kidneys and skin
- Urea - waste from the breakdown of body protein

What would happen if wastes were not removed?
- cells and tissues would be destroyed
- fever, poisoning, death
Parts of the Excretory System

The Kidneys
- Filters wastes from your blood.
- Is about the size of your fist.
- The body contains two, but can live off of one. (If problem with both a machine is needed to filter blood)
- Contains 1 million nephrons (filter unit) per kidney.

Ureters
- Tubes that carry wastes from kidneys to urinary bladder

Urinary Bladder
- Sac that stores liquid wastes removed by the kidneys

Urethra
- Tube that carries liquid waste (urine) from your bladder
- can be up to 1 litre of urine/day in a healthy person

Excretion and the Skin

3 Main Jobs of the skin:
- protects body from infection
- is a sense organ
- helps in the excretion of water and salts

Sweat Glands
- open onto the surface of the skin
- you have 2-5 million
- each gland gives off water and salt (but amount can't be controlled)
- helps body cool itself


http://www.youtube.com/watch?v=d-IJhAWrsm0

http://www.youtube.com/watch?v=wdBsm8ElwuM
Problems of the Excretory System

- can be damaged over time by high BP
- another cause of kidney damage is infection
- if both kidneys fail -- kidney machine or transplant

Dialysis:

http://www.youtube.com/watch?v=JXQb-0aDSrc&feature=related

http://www.youtube.com/watch?v=clp2OLPiosE

How does skin age?

http://www.healthline.com/vpvideo/skin