Human Systems - Respiration: Lesson 2 - Mechanics and Control of Breathing

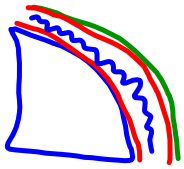
Mechanisms of Breathing

- Inspiration is before expiration (breath in before you breath out)

- Pressure differences between atmosphere and lungs determines air movement

- AIR IN: atmospheric air pressure is **greater** than lung air pressure

- AIR OUT: atmospheric pressure is **lower** than lung pressure



- The lungs lie in the **thoracic cavity**.

- The lung tissue itself is covered with a thin membrane called the **pleural membrane.**

- The pleural membrane also lines the walls of the ribs.

- Between the pleural membrane of the lungs and the ribs is the pleural space (cavity).

- The pleural cavity is a fluid filled space that helps the lungs expand and contract without **friction**.

- The walls of the thoracic cavity are formed by the ribs and two sets of muscles between the ribs, the internal and external intercostal muscles.

- The floor of the thoracic cavity is formed by the **diaphragm**.

Inhalation: Active (muscle contraction)

- diaphragm is dome shaped when relaxed, when triggered it contracts and lowers

- External intercostal muscles contract and cause the ribcage to move up and out when triggered

- These two movements causes the thoracic cavity to expand, and also the alveoli (lungs) to enlarge

- This lowers the pressure in the lungs and air moves in from the high pressure atmosphere to low pressure lungs

Exhalation: Passive (muscle relaxation)

- If lung volume increases above ~1.5 litres, stretch receptors in the lungs send a signal to stop inspiration

- The diaphragm will relax, rib cage moves in and down

- The elastic lungs recoil and air is pushed out

- Inspiration is active (muscle contraction) and expiration is passive (muscle relaxed) when we are breathing normal

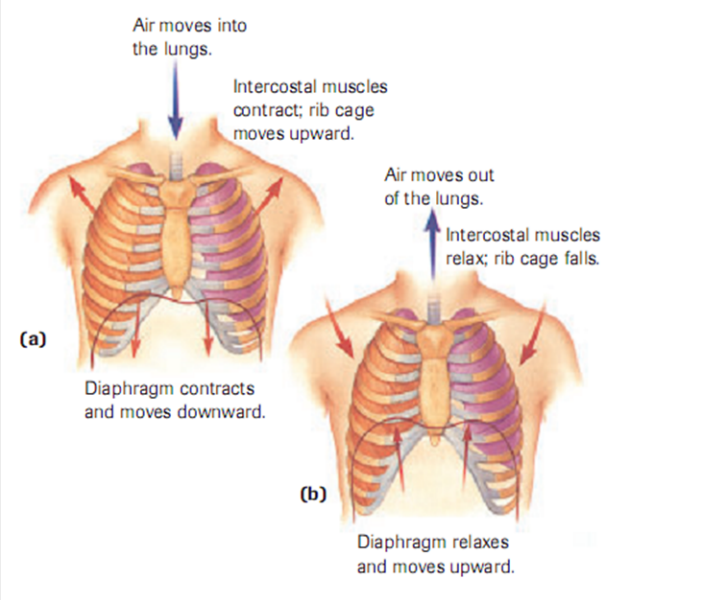
- Exercise can make expiration active:

    - Internal intercostal muscles can contract and pull the rib cage down and in

    - the abdominal muscles force guts against the diaphragm, forcing it up

http://www.nelson.com/ABbio20-30/teacher/protect/otr/Bio2030OTR/attachments/i_AnimationSimulation/breathing.html

http://www.nelson.com/ABbio20-30/teacher/protect/otr/Bio2030OTR/attachments/i_AnimationSimulation/gradient_changes.html



Regulation of Breathing

– controlled by the medulla oblongata

– several factors can influence breathing rate:

1. Chemicals in Blood

- **chemoreceptors** monitor the level of CO_2 and O_2 in the blood

a. CO_2 Receptors:

- CO_2 dissolves in the blood to form an acid

- the level of the acid is monitored by receptors in the medulla oblongata

- these are the most sensitive receptors and are the main regulators of breathing rate

- if CO_2 levels increase, the medulla oblongata sends a signal to the muscles of the diaphragm and ribs to increase breathing rate

- once CO_2 returns to a normal level, the chemoreceptors become inactive and breathing rat returns to normal

b. O_2 Receptors
- receptors in carotid artery and aorta detect level of O_2

- this is only a backup and these receptors are only stimulated when O_2 levels drop and CO levels remain constant eg) carbon monoxide poisoning, high altitudes

- receptors send a signal to the medulla oblongata which stimulates the muscles in the chest and cause an increase in breathing rate

2. Stretching of Lung Tissue
- stretch receptors in pleura, bronchioles and alveoli are stimulated

- nerve impulses are sent to the medulla oblongata (respiratory centre) which causes breathing rate to drop

3. Emotional State

- fear and pain cause an increase in breathing rate due to the increased need for O_2

Smoking - THE FACTS

a. approximately 87% of lung cancer deaths are smokers

b. Smokers are more susceptible to cancer

- pancreas, bladder, mouth, larynx, esophagus leukemia, cervix, kidney, stomach

c. Smokers are 3.5 times more likely to suffer from arterial disease

d. Smokers are 20 times more likely to suffer emphysema and bronchitis

e. Second hand smoke

- children of smokers have twice as many respiratory infections

f. fetus - low birth weight and higher miscarriage rate in pregnant smokers

g. approximately 20% of lung cancer deaths are due to second hand smoke