

Control of ventilation

- Brainstem (medulla oblongata)
 - Respiratory rhythm generator (RRG)
 - Sets ventilation rate
 - Inputs to set ventilation rate
 - 1. Pacemaker potentials
 - Set pace of ventilation rate
 - RRG works off of this rate
 - 2. Chemoreceptors
 - If chemical factors are off the chemoreceptors can change it to the ventilation rate
 - 3. Pulmonary stretch receptors
 - Make sure you do not put too much air in the lungs
 - Saves them from exploding
 - Pattern from RRG
 - Created from very set manor
 - Stimulates skeletal muscles → contract → expansion → inspiration
 - Stimulates diaphragm on bottom , intercostals on sides
 - Creates our inhale
 - No stimulation → relax → rebound → expiration
 - If we have a very large inhale (heavy exercise)

- We stop
- We are expanding so long
- Pulmonary stretch receptors activate and tell us we cannot inhale anymore
- Causes inhibition of motor neurons
 - Even if we are consciously trying to expand our lungs further we are impacting motor neuron which does not allow us
 - A reason we do not do rescue breathing for CPR anymore – can risk taking an adult size breath and put it into a child size lungs and blowing them out
- Chemoreceptors for P_{O_2} , P_{CO_2} and H^+
 - Impact of P_{O_2}
 - Threshold at ~60
 - The majority of the blood in the body is attached to hemoglobin (about 100%)
 - 60 is the number where we see that hemoglobin cannot hold on to oxygen anymore
 - But CR only bind free oxygen
 - Ventilation rate does not change bc we have no way of registering it
 - So we see no response with:
 - Changes in hemoglobin's affinity for oxygen
 - Q of the week: raise carbon dioxide level, carbon monoxide replaces oxygen, temperature, pH, DPG
 - We will not see a change in ventilation rate
 - Losses of Hb
 - Anemias occur
 - Do not have change in ventilation rate – do not breathe any harder
 - Need more sensitivity – CO_2 and H^+

- Impact of P_{CO_2} :
 - Main system for determining ventilation rate: amount of CO_2 in the blood
 - If you turn up CO_2 then you will breathe more
 - Sensitive to small changes
 - Dominant one that sets ventilation rate
 - Hyper- and hypo- ventilation
 - But:
 - High levels of CO_2 - where we expect high levels of ventilation rate
 - Kills critical cell type
 - Neurons
 - When we get up to a certain level of CO_2 our neurons die
 - Neurons are what make up RRG - if they get killed then nothing can make up the ventilation rate
 - High levels of CO_2 = NO VENTILATION
- Impact of H^+ : due to:
 - 1. HCO_3^-
 - 2. Anaerobic exercise:
 - Taking out production of CO_2 we do not have krebs or electron transport so our glycolysis creates lactic acid
 - Create lots of H^+ and anaerobic exercise creates metabolic acidosis
 - 3. Vomiting:
 - Creates acid that needs to be replaced
 - Creates a basic situation called metabolic alkalosis