



Let's Take Attendance



<http://sciovirtual.org/attendance>

Attendance code: liver58

Icebreaker (in chat): What's your
star sign?

Course Updates

- Course Challenge released today
- Homework #4 released from today
- All within 2 hours of end of class
- All due at end of Thursday so we can update points and everything by Friday's class which is the last class

Icebreaker

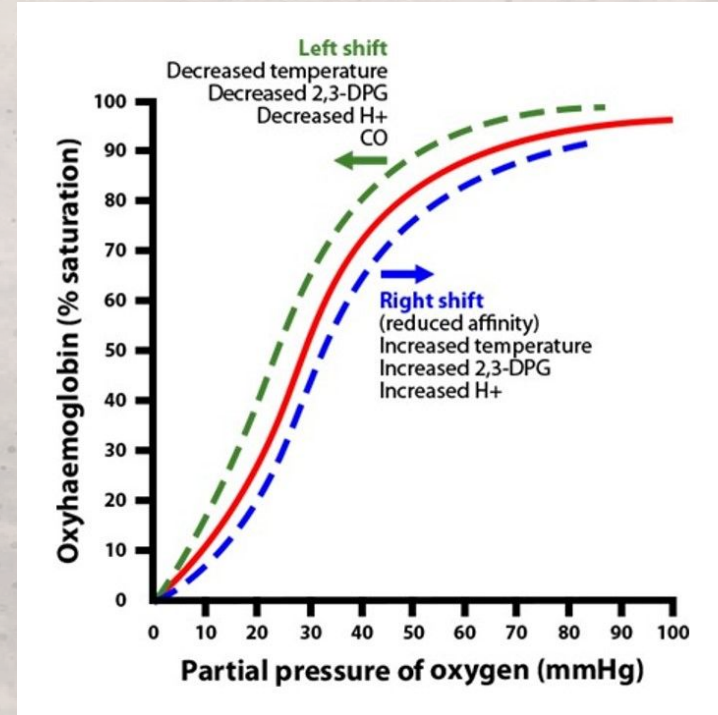
- Are you a morning person or a night person?
- If you could choose, would you rather travel into the past or future?
- If you could turn into an animal(other than a human), what would it be and why?

Respiratory Diseases



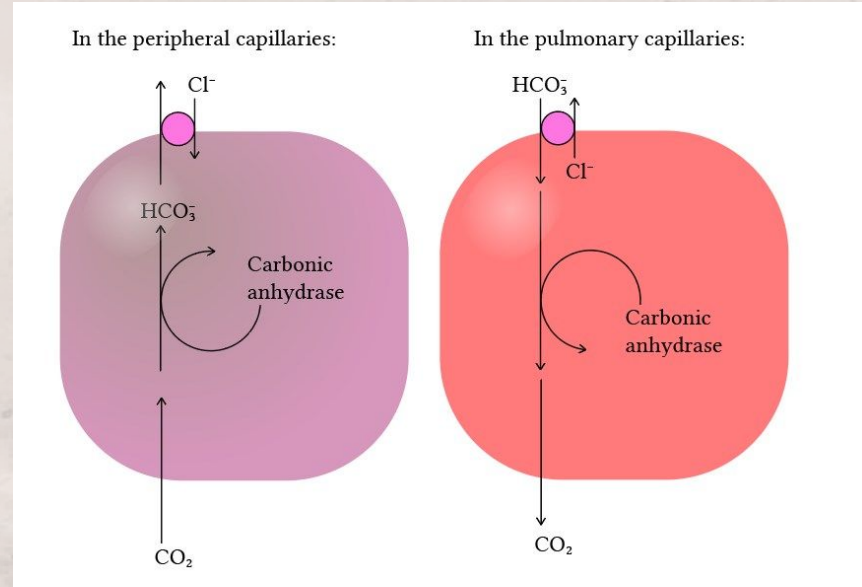
Review From Last Time!

- Cooperative Binding of oxygen to hemoglobin
- Bohr effect
 - CO₂ reduces Hb-O₂ affinity
 - Low pH reduces Hb-O₂ affinity
- Increased temperature decreases Hb-O₂ affinity
- Carbon Monoxide-Hemoglobin affinity is 200-300 times stronger than O₂-Hb affinity. Breathing in carbon monoxide causes Carbon Monoxide poisoning, leading to suffocation from a lack of oxygen
 - Carbon monoxide has no odor



An extension to last time: Chloride Shift

- In systemic circulation:
 - HCO_3^- is pumped out of the RBC to drive the reaction (below) forward
 - This allows for more CO_2 to be absorbed
- In pulmonary circulation
 - HCO_3^- is pumped into RBC to drive the reaction backwards.
 - This allows for CO_2 to be unloaded



carbonic anhydrase

Why is a chloride ion (Cl^-)? Why not sodium (Na^+) or potassium (K^+)?

Restrictive vs. Obstructive Diseases

- Reduction in lung volume
- Characterized by trouble inhaling air
- Often caused by stiffness in lung tissue or weak inspiratory muscles

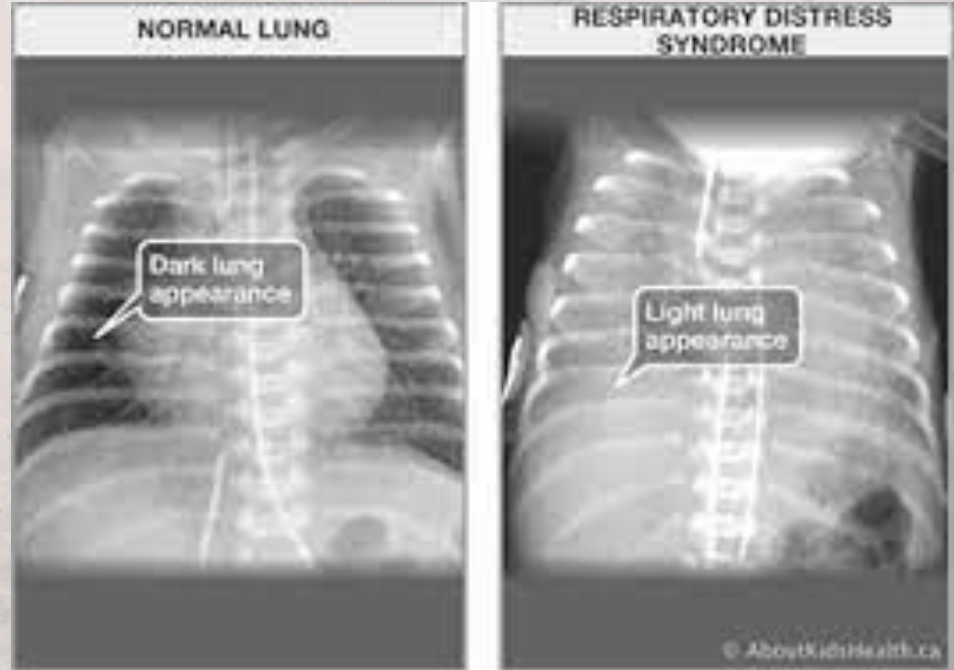
Caused by:
Pulmonary Fibrosis
Rheumatoid Arthritis

- Reduction in airflow
- Characterized by trouble exhaling air
- Lung volumes increase in obstructive diseases

Caused by:
COPD
Asthma
Bronchiectasis

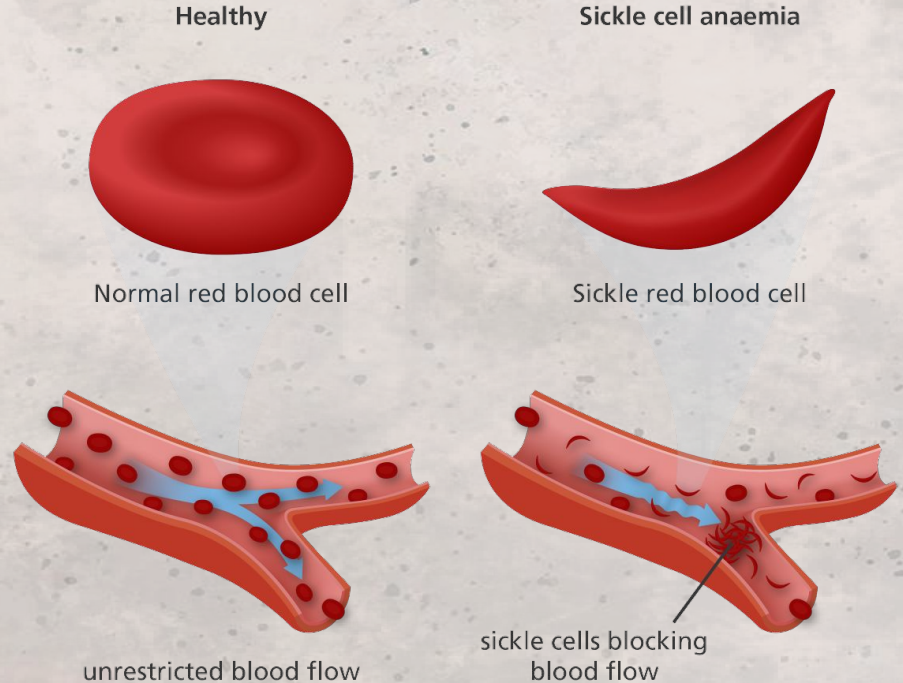
Respiratory distress syndrome

- Not enough surfactant in the lungs
- High surface tension decreases compliance of lungs, labored breathing
- small alveoli collapse



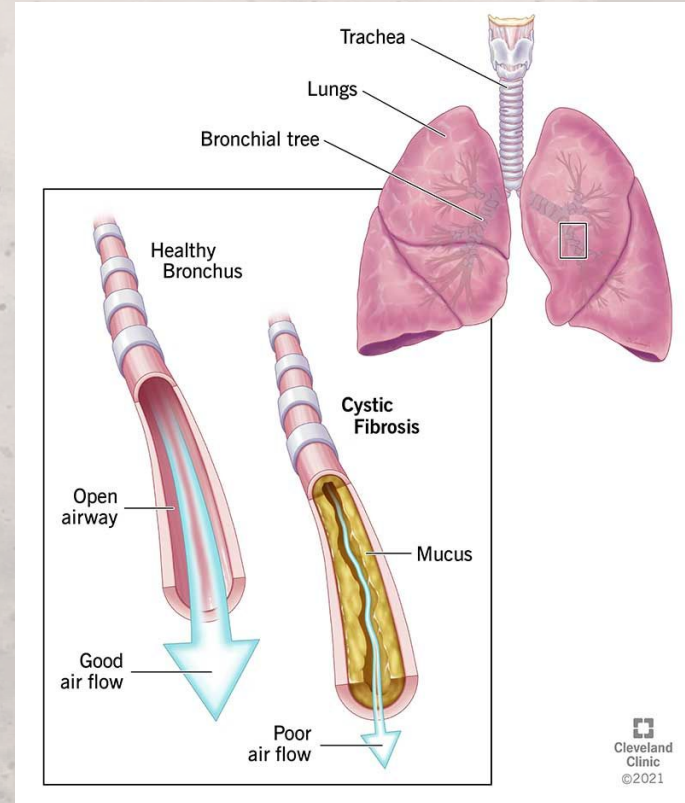
Sickle Cell Disease

- A mutation in a single nucleotide of a single gene causes sickle cell disease
- Hemoglobin polymerizes, leading to stiff and irregularly shaped blood cells
- Glutamic acid to valine mutation



Cystic Fibrosis

- Mutation in CFTR gene causes chloride to be trapped in cells, this increases osmolarity of cell, preventing water from leaving cell
- Lack of water in the airways leads to thickened, sticky mucous
- What other organs might this disease affect? (hint: which organs have mucosa?)



Pulmonary Fibrosis

- Tissue deep within lungs becomes scarred over time
 - Tissue gets thick and stiff
- It is hard for you to catch your breath and you blood may not get enough oxygen
- Causes include environmental pollutants, medicines, and connective tissue diseases
- Symptoms include loss of breath, dry cough, fatigue, aching and weight loss
- Diagnosis involves medical history, imaging, lung biopsy, and lung function tests
- Treatments include medicines, oxygen therapy, or lung transplant

Asthma

- Asthma is a condition in which your airways narrow and swell and may produce extra mucus
- Symptoms include dyspnea (shortness of breath), cough, wheezing
- Many of the causes are unknown although environmental exposure to certain elements may cause it
- Symptoms include sneezing, wheezing, etc.
- Diagnosis involves lung function tests and physical exam
- Treatment includes avoiding triggers, medication if needed and inhaler

Mid-Lesson Check In!

1. Any Questions For Us?

Type in chat your answers!

- What happens when there is a lack of water in your airway? (related to cystic fibrosis)
- Compared to a normal lung, how different does a lung with respiratory distress syndrome look like?

COPD

- Very common lung diseases.
- 2 primary forms of COPD are chronic bronchitis and emphysema; most sufferers have a combination of both conditions.
- Symptoms
 - Gradual (and irreversible) decrease in the ability to push air out of the lungs due to decreased lung compliance and elasticity.
 - Q!
 - labored breathing, called dyspnea.
- COPDs can be caused by smoking (the best form of prevention is not smoking), but can also be caused by rare genetic mutations or exposure to airborne irritants.

In **chronic bronchitis**, the bronchi become inflamed, and goblet cells produce unusually high amounts of mucus.

Emphysema

- Emphysema is a type of COPD
 - Other main type of COPD is chronic bronchitis
- Walls between alveoli are damaged and alveoli lose their shape to become floppy
 - May lead to fewer, larger air sacs
- Causes usually are long term exposure to irritants like cigarette smoke
- Symptoms include frequent coughing, shortness of breathing, squeaky sound when breathing, and/or tightness in chest
- Diagnosis includes physical exam, lung function tests and imaging tests
- Treatments include lifestyle changes, medicines, oxygen therapy, pulmonary rehabilitation and surgery

Pneumonia

- Infection of the lung.
- Community-acquired pneumonia is ordinary pneumonia; hospital-acquired pneumonia is acquired in a hospital.
- Multiple causes:
 - Bacteria (the most serious and common cause), and fungi.
- Symptoms
 - a cough, fever (mild or high), shaking chills, shortness of breath, confusion (esp. in older people), excess sweating and clammy skin, headache, loss of appetite, low energy, fatigue, and sharp or stabbing chest pains.
- Treatment
 - IV fluids and antibiotics, oxygen therapy, regular antibiotics, humid air, and deep breathing.
- Precautions
 - Hand-washing, not smoking, and vaccinations.



Anemia

POP QUIZ (ish): Guess which instructor has anemia!

- Blood disorder that can lead to some bad respiratory symptoms
- Number of healthy red blood cells that carry oxygen through the body drops to an abnormal level, or if the cells don't contain enough hemoglobin.
- Some people are actually more susceptible to anemia!
- **Breathing Issues, Dizziness, and Headaches**
 - Lungs overcompensate in order to bring in more oxygen, causing breathing difficulties.
 - Low levels of hemoglobin prevent adequate oxygen from reaching the brain.
 - Small exertions can cause shortness of breath or fainting spells.
- Chest pains and palpitations, cold hands and feet, cramping and tingling in limbs, fatigue, hypothyroidism, unusually pale complexion and nails, pica syndrome, problems with focusing

Acute rhinitis

- AKA the common cold.
- Funny nose, wheezing, teary eyes, and impairment of smell.
- Caused by bacterial/viral infections of the nose as well as inhaled irritants.
- Treatment includes rest, cold and cough medications, antibiotics and other treatments(herbs, vitamin C, etc.)

Hypoxia

- The whole body or a certain region of the body is deprived of oxygen.
- The classic symptom of hypoxia is cyanosis (skin turning blue), but it is not characteristic of all cases of hypoxia and is usually visible only in fair-skinned individuals.
- **Types**
 - Anemic hypoxia: characterized by an abnormally low number of red blood cells (RBCs) in the blood or RBCs with too little hemoglobin (Hb).
 - Ischemic hypoxia: characterized by an abnormal blood flow due to partial or complete blood vessel blockage.
 - Histotoxic hypoxia: characterized by the inability of body cells to metabolize oxygen even though adequate amounts of it are delivered. This type of hypoxia is caused by metabolic poisons (those that mess with cell metabolism), a common one being cyanide.
 - Hypoxemic hypoxia: characterized by abnormally low partial pressures of oxygen in the blood. Most commonly, it is caused by breathing in air which contains too little oxygen. Carbon monoxide poisoning is a special type of hypoxemic hypoxia.

Laryngitis

- Inflammation of vocal cords
- Caused by viruses(usually) or bacteria, allergies, heartburn or chemicals
- Symptoms include fever, hoarseness, and swollen lymph nodes
- Diagnosis includes a physical exam
- Treatment usually includes resting your voice, using a humidifier, decongestants and pain medications

Oxygen Toxicity

- Result from breathing molecular (pure) oxygen at high pressures (such as from oxygen tanks in scuba diving) for a long period of time.
- Can affect the CNS and pulmonary functions.
- Symptoms: tunnel vision, tinnitus, nausea, and behavioral changes
- Diagnosed through lung function tests and x-ray which can show signs
- Treatment includes reducing exposure to concentrated oxygen, air breaks and limited pressure treatment

Lung Cancer

- Cancer forming in the lungs(usually cells lining air passages)
- Causes/risks include smoking, secondhand smoke, asbestos exposure, radiation, air pollution, etc.
- Symptoms include chest pain, cough, wheezing, hoarseness, loss of appetite, fatigue, and trouble swallowing
- Diagnosis involves imaging and biopsy, along with lab tests and physical exam
- Treatments include radiotherapy, surgery, chemotherapy and other cancer treatments
 - This is starting to go into immunology stuff

Sleep apnea

When breathing repeatedly stops and starts while sleeping.

Obstructive sleep apnea; more common

- muscles in the back of the throat relax, narrowing or closing the airway.

Central sleep apnea

- brain fails to transmit signals to breathing muscles and is most commonly caused by heart disease.

Complex sleep apnea (both)

- an upper airway obstruction like obstructive, but patients also have problems with the rhythm of breathing and occasional lapses of breathing effort.

Symptoms

- Daytime hypersomnia, loud snoring, observed episodes of breathing cessation during sleep, abrupt awakenings, insomnia.

Treatment includes a continuous positive airway pressure, bilevel positive airway pressure, adaptive servo-ventilation.



Tuberculosis

- A contagious bacterial infection of the lungs
 - Can spread to other organs.
- Symptoms:
 - Weight loss, excessive sweating, and coughing up blood.
- Treatment:
 - Drugs such as Isoniazid and Rifampin.