CHAPTER 8 - CIRCULATORY SYSTEM

-**3 main parts of the circulatory system**: heart, blood vessels and blood

-**five systems that need blood circulation**: digestive system(stomach, small intestine, etc), hepatic portal system (liver), respiratory system (lungs), urinary system (kidneys), lymphatic system

-approximately 55% of blood is **plasma** —> which is 90% water

-the remaining 10% is made up of plasma proteins 7-8% (antibodies, hemoglobin, albumin, fibrinogen, and hormones) and 2-3% glucose, amino acids, lipids, mineral salts, oxygen, and carbon dioxide

-**platelets** are irregular fragments of white blood cells that also don't have a nucleus but are important for blood clotting, only survive about 10 days

-there is a small fraction of **white blood cells** in the blood

-**we have about 5.6 liters of blood in our body**

-if a blood vessel is damaged, the smooth muscle in the vessel will contract in an automatic response called a **spasm**

-**Calcium** and **Vitamin K** are needed for the functioning of enzymes involved in the clotting process

-**Fibrogen** is a protein that is also needed for clotting

-**Arteries** travel **away** from the heart and have **oxygenated** blood, with the exception of **pulmonary artery**

-Arteries, arterioles, venules, and veins all have ***four layers of cells***: epithelial(outside layer), connective tissue, smooth muscle, epithelial tissue again/endothelial(inside layer)

-**arterioles** are slightly smaller in diameter than arteries but continue to carry the oxygenated blood from the arteries to the capillaries

-**capillaries** are only one-cell layer with many pores in this **epithelial** tissue

-**venules** pick up the deoxygenated blood from the capillaries to deliver it to the veins

-**veins** deliver the deoxygenated blood back to the heart with the exception of the **pulmonary and umbilical vein**. The biggest vein is the **inferior vena cava**.

-**the four chambers of the heart**: right and left ventricles (lower positions that pump blood out of the heart) and the right and left atria (upper portions that receive blood entering the heart from veins

-the **septum** is a thick wall dividing the two sides of the heart

-the "lubb-dubb" you hear when listening to your heartbeat is actually the valves opening and closing

-**pulse** is the surge through the arteries every time the ventricles contract

-**blood pressure** is the pressure of the blood against the vessel walls and is measured during two phases of the cardiac cycle

-**systolic pressure** is the highest pressure and refers to the force of blood in the arteries when the ventricles contract

-**diastolic pressure** refers to the force of blood on the walls of the circulatory system while the heart is in complete diastole(relaxation)

-a healthy blood pressure is **less than 120/80 but more than 100/60**

-**hypertension** (high blood pressure) is often called the "silent killer" since it rarely shows symptoms but can lead to ruptured blood vessels, stroke, heart disease, kidney damage

-**hypotension**(low blood pressure) is not usually as dangerous but can indicate that there is not enough water or proteins in your plasma, that you're not making enough blood cells

-there are **two circulatory circuits**: the pulmonary circuit and the systemic circuit

-**there are four chambers of the heart enclosed by thick muscular walls**: right atrium, right ventricle, left atrium, left ventricle

-**flow of blood**: superior vena cava, right atrium, tricuspid valve, right ventricle, pulmonic valve, pulmonary artery, pulmonary veins, left atrium, bicuspid valve, left ventricle, aortic valve, aorta, arteries, arterioles, capillary beds, capillaries, venuoles, veins, superior/inf

- **sinoatrial (SA) node**(pacemaker) set the rate of the heartbeat by sending out an electrical signal to start the contraction of the heart muscle

-**deoxygenated blood flow**: vena cava > right atrium > tricuspid ("lubb") > right ventricle contracts > pulmonic valve ("dupp") > pulmonary artery > arterioles > right and left pulmonary capillary beds >

-**oxygenated blood flow**: venuoles > right and left pulmonary veins > left atrium > bicuspid > left ventricle > aortic valve > aorta > arteries > arterioles > capillaries > venuoles > veins (and then back to vena cava)

-**chordae tendineae** are tendons made of cartilage and elastin connecting the papillary muscles of the heart to the valves

Types of heart disease and their causes

-**heart failure** the most expensive health problem in the united states, when the heart is not pumping blood as efficiently as it should be

-**coronary artery diesease caused by atherosclerosis** is the number-one heart disease in adults. This is when the arteries are clogged or weakened by the accumulation of plaques composed of fats, cholesterol, dead cells, macrophages, and calcium

-**heart attack** is when not enough oxygen and nutrients are delivered to the cardiac muscle cells, and the cells die

-**hypercholesterolemia** refers to high cholesterol in the blood (high LDL levels) and can lead to heart disease and stroke

-**blood clots** from platelet accumulation block blood vessels and can stop the flow of blood altogether

-**embolism** are blood clots that break free from the site of the origin to another site to cause blood vessel blockage

-**stroke** is a term used to signal the loss of brain function due to lack of blood flow to the brain — STR (smile, talk, raise both arms)

-**aneurysm** when an artery vessel wall balloons outward due to weakening of the blood vessel

-**cardiomyopathy** is a chronic disease that causes the heart to weaken

-**arrhythmia** is an irregular heartbeat whether abnormally fast or slow, skipping beats

-**septicemia** some bacterial infections destroy red blood cells and prevent clotting

CHAPTER 9 - RESPIRATORY SYSTEM

-**cigarettes are the number one cause of preventable disease and death**

-tobacco is a **carcinogen** which means a substance that can cause cancer

-smoking increases your chance of **heart disease and stroke**

-50% of long-term smokers eventually die of smoking-related causes

-air = 79% nitrogen ~ 21% O2

-we need every cell in our body to make **energy/atp**

-CO2 we make during cellular respiration we need to exhale because it's toxic

-the **respiratory system** is composed of the **nose, airways, and lungs**

1) nose 2) pharynx 3) larynx 4) trachea 5) bronchi 6) lungs 7) bronchioles 8) alveoli

-nose: bring air into nose, nose hair part of barrier system

-uvula: flap between nasal and thraot areas

-pharynx: (throat) leads to both digestive system and respiratory

-larynx: 9 pieces of cartilage, 1st is epiglottis

-trachea: wind pipe

-bronchi: big tubules heading into lungs that bunch into the bronchioles

-alveolis: air sacs where gas exchange occurs with the capillaries

-**ventilation** refers to the mechanism to get O2 in and CO2 out

-**the number one threat to the respiratory system is tobacco**

-diaphram is the skeletal muscle that helps us move O2 into resp system

-**bronchitis** is usually bacterial infection > treated w antibiotics

-**asthma**: when bronchioles constrict/close up and it makes it hard to breath

-**pneumonia** extra fluid/mucus in the air sacs

-**aprea** sometimes people stop breathing due to diaphragm not contracting on the airways are blocked

CHAPTER 10 - DIGESTIVE SYSTEM

-main functions is to get nutrients into blood so we can use them all throughout the body

-take food into mouth, break down food w teeth and tongue and form into ball = bolus

-saliva is secreted to help w digestion

-**salivary amylase** helps break down carbohydrates + lysozyme enzyme

-swallow bolus from throat/pharynx

-the stomach is a big sack w smooth muscles to churn the chyme + gastric juices

-3 parts of the small intestines: duodenum, jejunum, ileum

-**Layers of small intestines**: mucosa layer, submucosa, muscularis, serosa

-**large intestines** absorb water from large intestines into capillaries her + bacteria in the large intestines are helping to break down cellulose

-**rectum** where the waste is stored

-**functions of the liver**: 1) makes bile from cholesterol store in galbladder, then deliver to duodenum 2) makes leptin hormone from fat cells 3) excess glucose is converted into glycogen and stored in liver 4) detoxifies different toxins like alcohol

-**Some ways people die from alcohol**: 1) Alcohol poisoning 2) Drowning of alcohol-going into the respiratory system 3) Asphyxiation from vomit 4) Liver/other organ problems 5) Heart attack 6) Car fatalities/accidental drowning/fights/sexual assaults

-**Other functions of the liver:** 1) Leptin- suppressor 2) Bile- made from cholesterol-stored in the gallbladder- breaks down fats 3) Glucose- glycogen 4) Detoxify alcohol 5) Convert excess amino acids- ammonia- urea(goes to kidneys) - we pee out 6) Break down old hormones : red blood cells to be excreted in urine 7) Liver converts lactic acid into a less toxic form/breaks it down

-**Mouth, Pharyxn, Esophagus, Esophageal sphincter, Stomach, Pylaric sphincter, Small intestine, Large intestine, Rectum Anal sphincter**

-Digestive Issues: **Diarrhea**- different reasons might cause the small intestines to send the chymel nutrients through the digestive system to the large intestine faster that usual so there is not enough time to absorb the nutrients: H2O into the blood so you end up with watery waste, due to pathogen or nervous during menstruation for some females **Constipation**- hard to expel waste- not enough h2o or not enough cellulose fiber- good supply from fruits & veggies

CHAPTER 11- NUTRIENTS

-**Nutrients** anything our body needs that we can't produce

-Macronutrients- carbohydrates, proteins, fats

-Micronutrients- vitamins, minerals

-**Good Whole Grain:** Popcorn, Oatmeal, Whole grain bread, Cereal, Quinoa, Barley, Rye, Brown rice, **Proteins**- building blocks are amino acids. We can make 10 a.a. But we need to get the other 10 from our diet = "essential a.a.s.", **Complete food**- animal products have all 10, soy, quinoa, spirulina

-**BMI** Body mass index (an estimate of body fat)

$$\frac{\text{weight(lbs)} \times 700}{\text{inches(height)}^2} = \text{BMI}$$

-**BMR** Basal metabolic rate

-Metabolism = breaking down food to make ATP/energy - total # of calories you need per day

-Nutritional Facts: **Proteins-** 0.8 g per 2.2 lbs, **H2O-** weight/2 = ounces of H2O, **Sugar-** 8 tsp/day = 32g, **average American consumes 30 tsp of sugar per day,* **High fructose corn syrup (HFCS)-** we are not designed to use this for energy as well as natural sugars, so we convert to fats, * one of the main reasons for obesity

-**Obesity**: ⅓ of our population is obese, Health risks are high with excess weight, Heart disease, Cancer, Diabetes Type II (insulin resistant), **Causes of Diabetes Type II**: Poor diet, Lack of exercise, Not enough sleep, Stress

-**Malnourishment**: Not getting enough nutrients, Mental health issues, Anorexia- not consuming enough nutrients, Bulimia- not getting enough nutrients due to purging food (vomiting, laxatives) — Gum/tooth decay, Esophageal GI problems

Micronutrients (vitamins & minerals)

-Vitamins: **Vitamin C** helps make collagen and helps boost our immune system, Not enough Vitamin C can cause **scurvy, VItamin D** helps us absorb calcium, We can make ourselves with the help of sunlight, Not enough Vitamin D can cause **Rickets**

-**Folic acid**: bacteria in large intestines that make coenzyme to help make nucleic acids (ex: DNA and RNA)

-**Minerals**: **Iron**- helps us make blood cells, Deficiency in this causes **anemia** , Meats, spinach, beans all have a lot of Iron, **Calcium**- for bones, muscles, nervous system, blood clotting, milk production, etc.

-Saturated(bad) Vs. Unsaturated(good) Fats

Saturated	Unsaturated
-harder for the body to break down	-easier for body to break down & use
-solid at room temperature	-liquid at room temperature
Animal fats: -cheese -butter -meats	good sources: - nuts/seeds -olives -avocados -fish*
LDL = bad cholesterol	HDL = good cholesterol

-**Superfoods to add to your diet**: Spinach, Soy/tofu, Blueberries/cranberries (antioxidants that help fight cancer), Yogurt, Apples, Oranges, Eggs, Oatmeal, Quinoa, Flax seeds, Bananas, Fish: salmon, shrimp, Avocados, Walnuts

-**Maintaining Weight**: Exercise 30 minutes to an hour, In order to burn fat, you need to burn 3,500 calories for 1 lb of fat (60-90 min/day)

-**Sleep**: Crucial for proper healthy body, Not enough sleep can cause us to release more ghrelin (then we're hungrier), less leptin (you eat more if this suppressant is not being released), Inhibits insulin working properly- can cause Diabetes Type II, Stress hormone(cortisol)- also inhibits insulin, Lack of sleep inhibits growth hormones

CHAPTER 12- URINARY SYSTEM

-**Urinary system**- functions- balance H2O + salts / electrolytes: pH as well as excreting waste=urine- mostly h2O

-**Urea** = what the liver makes from excess amino acids -> ammonia -urea + uric acid (converted from excess nucleotides)

-**Urochrome**- pigment from broken down red blood cells

-**Old hormones**-toxins

-We send our blood to the kidneys to filter + balance/purify: excrete waste

-The main function units of kidneys are **nephrons**- we have 1 million per kidney, Nephrons are making urine in kidneys, Hormone released from the kidney is **Erythropoietin**

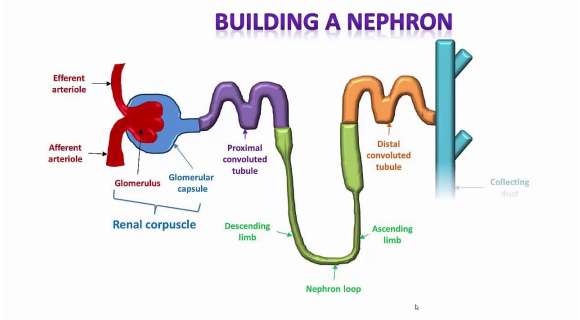
-Erythropoietin- stimulates the production of red blood cells from bone marrow

-**H2O is the most important substance in our body:** We lose it constantly through sweat, breath, urine, feces/poo, We need to replace it

-**2 hormones help regulate the nephron activities**

1) Aldosterone- secreted from adrenal glands (right on top of kidneys) and activates salt pumps in the nephrons- in loop of blanle distal tubules

2) Antidiuretic hormone- from brain to open channels in the collecting ducts of the nephrons to reabsorb more h2o in our blood + tissues when we need to conserve h2o, Alcohol and caffeine block this hormone so channels don't open - we lose more h2o through urine



-Glomerular capsule = **Bowman's capsule**

1) Bowman's capsule- filtration occurs here- plasma enters the nephron tubules from capillaries. Particular capillary bed that goes around the nephron to reabsorb what we need to keep

2) Proximal tubule- reabsorbs nutrients like sugars

3) Descending limb- reabsorbs water

4) Ascending limb- reabsorb salts passively here

5) Distal tubule- actively reabsorbs salts with salt pumps

6) Collecting duct- open channels to reabsorb more h2o if we need it

-**Urinary System Disorders** — UTI = urinary tract infection - bacterial infection treated w/ antibiotics because if the infection moves up to the kidneys = pyelonephritis (can be very dangerous/deadly)

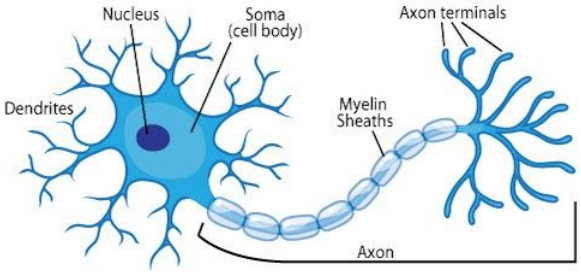
CHAPTER 13- Nervous system- neurons, nerves, neurotransmitters

-**Neurons**- main cells of the system

-**Nerves**- bundles of axons sending messages

-**Neurotransmitters**- Chemicals that go between neurons to help transmit the signals-cause responses in the target cells

-Neuron



-Myelin Sheaths made up of Shwann cells (a type of glial cell) provide insulation for the axons so messages travel faster

-Axon- transmits the action potential = message/stimulus, Works with electrolyte transfers across the axon

-Terminal buds have neurotransmitters that are released across the synapse

-An action potential occurs when a stimulus is detected by the dendrites- triggers sodium (Na+) to enter the axon which trigger potassium (k+) to exit the axon- a chain of electrolyte transfer heps send signal down axon

-**3 Types Of Neurons: 1) Sensory neurons**- accepting messages from senses- from internal / external stimuli 2) **Motor neurons**- causes a response by triggering muscles, glands, skin, organs 3) **Interneurons**- go between neurons

-Our main cells in the nervous system = neurons- the helper cells = glial cells- they provide metabolic activity for neurons, can protect provide insulation -some can repair damage

-The Peripheral Nervous System Has 2 Divisions

1) Motor Division- somatic division = voluntary motor division (skeletal muscles)
2) Autonomic Division- involuntary motor division (smooth muscles)
    a) Parasynthetic- normal relaxed state
    b) Sympathetic- excited state- fight, flight, freeze, fright, funcite (sex)
        i) Heart speeds up, digestion slows, breathing speed increases, pupils dilate

-**Brain Disorder/Injury**

1) Concussion- blunt force to the head can cause severe damage multiple can cause dementia
2) Alzheimer's- protein plaques build up in the brain, then messages down the neurons are harder to transmit
    - early onset = genetic risk
    - late onset = risk factors: smoking, drugs, alcohol, inactivity, concussions, not enough brain usage
3) Multiple sclerosis- autoimmune disease - immune system attacks schwann cells around the axon
4) Huntington's Disease- dominant genetic disorder (only need 1 gene, neurons start to degenerate ~ 40-50 years old