January 4, 2018

- Levels of Organization of the Body
- Hierarchical Organization
  - chemical
  - tissue
  - cellular
  - organ
  - system
  - organismal
- Four basic types of tissues:
  - epithelial
  - connective
  - muscle
  - neural
- Surface area to volume ratio

6 : 1
24 : 8 (3:1)
54 : 27 (2:1)

- Digestive System, adaptations for surface area
- intestines and at the teeth level (because the better you mechanically break down food, the easier it is to eat it)
- digestion enzymes work more efficiently if there is a large SA/Volume ratio of the substrate
- How does intestinal design speed up absorption?
  - Plicae— folds in wall of intestine
  - Also lumen
  - Also microvilli
- Digestion functions: mechanical breakdown, propulsion, digestion, absorption

- How do the liver and pancreas aid digestion?
- Bile: bile salts (fat digestion)
- Pancreatic juice (sodium bicarbonate [neutralizes stomach acids] and digestive enzymes [enzymatic breakdown starts])
- liver sends bile salts to gall bladder which releases them into intestines which are reabsorbed into blood stream and transported to back to liver (recycled)
- bile salts break into fat globule and break it into fat droplets

- Applied Physiology: Gallbladder disease
- rate of emulsification decreases when gallbladder is removed— low SA/Vol ration— rate of digestion is slowed down and so is rate of absorption, so there will be a ton of fat left over in your feces

- Describe organization of the liver's epithelial cells
    - all cells touch blood vessels— means they take stuff from circulation (ex: glycogen [complex sugar])
    - liver also stores fat— too much fate = enlarged vacuoles = impairs liver function— not all cells can touch a blood vessel (can result in cell death— eventually overall liver failure)— decreased SA/Vol ratio

January 5, 2018

- microvilli = cellular level
- villi = tissue level
- homeostasis = a dynamic equilibrium
    - normal range— lower tolerance limit to higher tolerance limit (body can regulate so long as you are within tolerance limits)— beyond limits, outside intervention is necessary to prevent death
    - temperature (above tolerance = death, protein denature, tissue damage accelerates, convulsions, cell damage) (below tolerance = loss of muscle control, loss of consciousness, cardiac arrest, skin blue, death)
- negative feedback = move variable in opposite direction of stress— rate of change decreases as variable reaches normal values (rate of change decreases, but not as a constant rate) [blood pressure]
- positive feedback = response moves body in the same direction as stress— rate of change increases as variable reaches tolerance limits (increase not at a constant rate) [birth, blood clotting]
- Describe the roles of the receptors, control center, and effectors in a homeostasis pathway:
    - 1. stimulus (produces change in variable)
    - 2. receptor (detects changes)
    - 3. input (information sent to control center)
    - 4. output (commands sent from control center)
    - 5. response (effector's regulatory response based on control center commands) [effector and response are disparate terms] (effectors do the action)
- blood sugar regulation (hormones: alpha cells [glucagon], beta cells [insulin])
- insulin is the key which lets sugar into the cells, produce by beta cells, and secretes hormones into the blood stream
- glucagon is a signal for stored sugar to be released
- for blood sugar, the cells are both the receptors and the control centers
- Diabetes: type 1 is an insulin insufficiency; type 2 is an overworked pancreas which makes cells of body resistant to insulin

January 8, 2018

- what is the difference between chemical and mechanical digestion?
- where along the digestive tract can you find mechanical digestion?
- how is blood glucose regulated? be able to draw feedback loops.
- epithelial cells— be able to name what they do

- homeostasis at a molecular level: chemical pathways have feedback inhibition loops
- when end product is high, it binds to enzyme (concentration, not agency) to inhibit substrate binding

- ionic bond = give/take electrons and are then attracted to each other (because they are oppositely charged) —> formation of an ionic compound
- ex: NaCl, but water (a polar molecule) messes this up (they go back to being separate)
- covalent bonds = share electrons to complete outer shell
    - polar covalent bonds: slightly negative and slightly positive sides (electrons spend more time near larger nucleus)— an unequal sharing of electrons
    - non-polar covalent bonds: same charge on both nuclei because electrons spend equal time near each nucleus
- since your body has a lot of water, ionic bonds release less energy than covalent bonds [RESEARCH THIS]

- catabolic reactions = breaking bigger molecules into smaller things (break molecules into monomers)
- anabolic reactions = makes broken down elements back into bigger molecules
- enzymes lower the energy it takes to recoup bonds— used for anabolic stuff i think
- THIS IS CHEMICAL DIGESTION = use of enzymes to break covalent bonds

- what is metabolism?
- energy balance: E in = E stored + E work + E heat (lost)
- chemicals (potential energy) = protein, carbohydrate, fat —> cellular (potential) energy) = ATP / metabolism = cellular work —> heat (kinetic energy) [breathe out CO2, sweat, radiates out of SURFACE AREA]
- depending on surface area to volume ration, you lose more or less heat

- which tissues contribute the most to your basal metabolic rate (BMR)?
- look at graph/chart thing
- BMR slows down as we age because we stop growing

- BMI = weight/height^2 (kg/m^2)
- a problematic measure…so why do we still use it? because it's easy
- BMI doesn't look at fat distribution

- visceral fat = correlated with metabolic syndrome (metabolic syndrome = high risk for cardiovascular disease)

January 9, 2018

- chemical composition of the body: 50-60% water
  - solids are proteins, lipids, minerals (NA, CL), carbohydrates, and miscellaneous
- why so much water?
  - 1. water is our solvent
  - 2. many chemical reactions depend on water
  - 3. high heat capacity = consistent body temperature in many environments (it takes a lot of heat to change water by even one degree)— we don't have to keep using ATP to regulate body temperature (doesn't boil/freeze every time a chemical reaction happens)
- solvent = the dissolving agent (the liquid within which everything is dissolved in)
- symptoms of dehydration— blood thickens/volume is reduced (heart pounds), fatigue, dry mouth/skin/etc, dizziness, headache (related to blood pressure), nausea, hallucinations
- eventually, metabolism is super affected (because water is involved in chemical reactions)— can't break things down or build them

- what are key properties of water molecules?
- water molecules are polar— they form hydrogen bonds (attraction between water molecules)
- oxygen-hydrogen atoms form (O-H) polar covalent bonds because they share a pair of electrons unequally
- what is metabolic water? it is the water that is made through metabolism
- hydrogen bonds make water sticky
- SURFACE TENSION (tear film) (beads of sweat) (belly flop)— learn more about surface tension
- hydrophilic = like water because of polarity/charge (things that like water have charge)
- hydrophobic = neutral things— water builds a cage around hydrophobic molecules
- don't forget about bile salts

- acids = proton donors (positively charged)
- bases = proton acceptor (negatively charged)
- all molecules of a strong acid will ionize in water and release H+ ions

- pH scale: high = negative law (low concentration of hydrogen ions) and vice versa

- buffer = something that regulates (not active control though— it automatically balances) pH
- ex: bicarbonate buffer system
- bicarbonate reserve in kidneys with help of breathing helps regulate blood pH

if blood pH is too high— chemical receptors send signal to brain, breathing slows down, carbon dioxide builds up in blood, carbonic acid

- the above is an example of homeostasis

January 10, 2018

- what is a carbohydrate?
- simple (monosaccharides and disaccharides) [glucose, fructose, galactose and maltose, lactose, sucrose] vs. complex (polysaccharides) [starches, fibers, glycogen]
- one sugar, two sugar, a bunch of sugars
- how to recognize a carbohydrate: numerous hydroxyl groups, only carbon hydrogen and oxygen, carbon ring (with the hydroxyl groups) [glucose = hexagon, fructose = pentagon]
- sucrose = a glucose and a fructose combined— an H20 comes off to bind, so to take these two apart, we would need water
- humans spend more time taking sucrose apart while plants make it
- when sugar dissolves in water, it doesn't appear the same way as salt— glucose and fructose attach with covalent bonds (hydrogen bonds hold the individual sugar groups together), so when you add water, it breaks disaccharides away from each other (away from buddies), not down into monosaccharides

- complex carbohydrates: groups of sugars all bundled together (the polysaccharides)
- our bodies store carbs as glycogen, and we can also digest starch (we can't fundamentally digest cellulose)
- why glycogen?
- take in stuff, goes to intestines, get to liver via digestion and absorption, stored in liver as glycogen, and then other stuff happens
- we store sugars as glycogen because it has more SURFACE AREA— more branching— surface area matters because we break things down via enzymes
- cellulose is too tightly packed to break down rapidly (also, we don't have the enzymes), but we should eat it because it aids in digestion (adds bulk to weight, increases regularity of defecation, keeps enough water in stool)

- lipid
- fatty acid = long carbon chain bordered by hydrogen with a tail of oxygen/hydrogen

- understand the difference between triglycerides (neutral fats)
- hard/solid = saturated fat
- oil = unsaturated fat (because less strictly organized)— more healthy
- the trans fats are the unhealthy fats: you can take a kink and make it straight to get this fat = more workable oil for capitalism

- these fats are bad because it doesn't know how to deal with these— they are unnatural and something that your body (specifically the enzymes) can't recognize, lead to increased cholesterol levels and inflammation in body

- what is cholesterol? how is it useful? — it is used to create bile salts (great for emulsification!), for cell membranes, and testosterone
- cholesterol is not a triglyceride because it has been broken down

- proteins amino group, carboxyl group, hydrogen, carbon, r group
- amino acids share carbon, carbon, nitrogen
- 20 types of amino acids (combined to create the proteins which exist in our body)— they attach to each other via covalent bonds between each amino acid call PEPTIDE bonds
- primary structure, secondary structure (fold into unique 3D shapes), tertiary structure, quaternary structure
- proteins fold because polar and non-polar side chains (r groups)

when salt dissolves in water, ionization happens (ionic bonds break)

January 11, 2018

- primary (peptide/covalent) bonds are the strongest bonds in a protein's structure— all other levels are weaker (hydrogen, opposite charge attraction, etc.)
- the different levels of structures rely on different levels of bonds

- how does an enzyme work?
- active site, substrate bonds, enzyme changes shape slightly as substrate binds, get different products
- active site has polarized structures in such a way that allow the substrate to be attracted/fit into it— also shapes of binding sites matters
- are enzymes used up in a reaction? NO.

- aw shit, read the slides for how enzymes work

- cell membranes make a barrier between the extracellular and intracellular environments
- cell membranes are called a fluid mosaic because they're flexible, made up of a mosaic of things, hydrophobic/hydrophilic = things can pinch off, the things within it move, it is wiggly
- hydrophobic tails interact with each other and hydrophilic heads interact with the water
- phospholipid bilayer creates a barrier, which doesn't allow large, charged/polar things through
- fat-soluble things can get through (cholesterol, some hormones, and really small things [like oxygen])

- diffusion is a passive process
- diffusion = solutes move in solution so as to achieve equilibrium
- at equilibrium, they still move because random motion
- protein channels also allow passive diffusion
- carrier mediated— binds, shape changes from the result of binding, this is still passive and does not rely on ATP because it is relying on a gradient
- osmosis— aquaporin channel or across bilayer
- active transport = moving against gradient

- look up role of glucose in beta cell
- beta cell is the receptor AND the control center in the blood sugar feedback loop

look up glycogen vs. glucagon

January 12, 2018

- active transport = against gradient and use of ATP
- 2 & 4— but 4 is secondary active transport (uses a different gradient to move something against its gradient— not ATP)
- endocytosis = being taken into the cell
- exocytosis = being expelled from the cell
- both endocytosis and exocytosis count as active transport because ATP is required

- osmosis— moves because of gradients
- water moves down its own gradient— it moves down the solute gradient (from low solute concentration to high solute concentration)
- hypertonic solution
- hypotonic solution
- isotonic solution
- think about how this will affect cells (surface area to volume ratio too and stuff)

- cellular organelles
- can be divided into membranous and non-membranous organelles
- nucleus, Golgi apparatus, endoplasmic reticulum are membrane-bound— it means that something is going to be entering or leaving it (different inner and outer environment)

- cellular organelles are small and numerous because surface area
- organelle membranes made up of phospholipid bilayers— high surface to volume ratio = more efficient
- mitochondria have inner membranes and outer membranes— convert glucose with oxygen to carbon dioxide + water + ATP
- lysosome = membrane-bound, digestive organelle— phagocytosis (the eating of cells), autophagy (damaged organelle eats/breaks it down), receptor-mediated endocytosis (cells bring in macromolecules which are then broken down by lysosomes)
- lipotoxicity can affect lysosome function
- too many free radicals also disrupt structure of lysosomes (change shape)
- when lysosome activity is affected, waste builds up, less efficient, and surface to volume ratio gets too low
- what makes lysosomes efficient at digestion? look at slide

January 16, 2018

- cytoskeleton: intermediate filaments (strong, structural support) [bundles of small filaments], microtubules (hollow inside— create highways inside the cell) [bigger to facilitate more efficacious transportation], microfilaments
- microvilli: found on epithelial cells of the small intestines
- cilia: on epithelial cells of airways— move stuff across the membrane (there are motor mechanisms inside them)
- similarities: both increase surface area, both involved in transportation (of different kinds)
- differences: on absorbs or secretes and the other propels stuff

- overview of cell functions

- protein synthesis
- DNA: how is it stored?— chromosome = most wound up/compact, chromatin is strand form
- protein synthesis occurs when DNA is in chromatin form (DNA is wrapped around histones— used to regulate what is available for synthesis and to later wrap it up)
- how does the cell divide which parts are available for synthesis?— non-coding regions match up with histones and so are not exposed
- look at acetyl vs methyl group (methyl makes it less accessible i think)

- double helix: bonds between pairs of nitrogen bases
- we keep DNA in the nucleus because we don't want to mess with the original DNA other than making copies

- DNA is not lipid soluble because it makes hydrogen bonds between base pairs which means polar and polar does not mix with lipids— also the phosphate group is negatively-charged, and there's an OH
- DNA to mRNA (transcription) to tRNA (translation) to folding
- tRNA needs to be modified because some pieces need to be removed during folding
- most proteins will be used inside the cytosol or will be shipped outside the cell
- mRNA is not a protein
- rough ER and Golgi apparatus are membrane bound— after translation, protein chain is dumped into lumen of ER via transport vesicle (advantageous for protein folding)

January 17, 2018

- emulsification = forceful mixing of things that would not usually mix
- bile salts are made of cholesterol— they can do this because one side is hydrophilic and one side is hydrophobic (the cholesterol side)— bile salts get in between and help break it up
- when proteins get mis-folded, what happens? many diseases are the result of plaques (the build-up of mis-folded proteins)
- many proteins have chaperones to monitor/help folding of protein— can sometimes signal lysosomes if something needs to be destroyed

- stem cells
- totipotent = can turn into anything (embryonic too)
- pluripotent = can turn into endoderm, mesoderm, ectoderm (this is embryo phase)
- multi-potent = adult stem cells
- differentiated cells are when they have actually become a distinct type of cell

- high BMI, but no other metabolic abnormalities = healthy obese
-

1. D
2. C
3. A
4. C
5. B
6. C

7. B
8. D
9. A
10. D
11. D
12. D
13. C
14. B
15. B
16. C
17. D
18. C
19. A
20. **C— when blood glucose falls below normal, alpha cells of the pancreas release more glucagon, leading to more glucose in plasma**
21. A
22. C
23. D
24. A
25. D
26. **B**
27. C
28. A
29. C
30. B
31. A
32. **B/A**
33. B
34. B
35. D
36. A
37. D
38. C
39. C
40. C
41. C
42. A
43. **A— to make ATP, the mitochondria require oxygen to completely break down glucose into carbon dioxide and water**
44. A
45. B
46. A

47. **C— as stem cells differentiate into the different types of epithelial cells in the pancreas, they become less capable of ongoing mitosis and more unique in their gene expression**
48. D
49. A
50. A

January 19, 2018

- bone is connective tissue— 67% inorganic
- 99% of the body's calcium is in bone
- bone is dynamic— it is broken down and remade all the time
- osteoblasts secrete bones
- osteoclasts destroy bone— transport out H+ ions
- 7-dehydrocholesterol (probably misspelled)
- just look this up. don't wanna take notes today.

January 24, 2018

- around 20% of people with type two diabetes are "exercise resistant." The don't get the benefits.

February 2, 2018

- blood clotting— an example of positive feedback in the body
- hemostasis
  - vascular spasm (smooth muscle contracts causing vasoconstriction), platelet plug formation (injury to lining vessel exposes collagen fibers; platelets adhere— platelets release chemicals that make nearby platelets sticky; platelet plug forms), coagulation (fibrin forms a mesh that traps red blood cells and platelets forming the clot)
- collagen fibers (connective tissue), endothelial cells, smooth muscle make up blood vessels
- how do we get from bleeding wound to stabilized clot?
  - clotting is a cascade of factor activation— each activated factor acts as an enzyme to activate the next
  - it is advantageous to have 13 coagulation factors (many steps) because it means you don't clot by accident and there are many places to regulate/stop clotting if necessary
  - look at diagram
- hemocytoblast —> megakaryoblast —> megakaryocyte —> platelets
- megakaryocytes have really large rough ERs so it's probably synthesizing a bunch of proteins
- platelet production: thrombopoietin is constitutively (always) produced by the liver— megakaryocytes and platelets metabolize TPO which reduces blood levels of TPO which means less platelets are made in the bone marrow— negative feedback
- there are a lot of clotting factors and platelets have A LOT of receptors. Why so many receptors on the surface of a platelet?
  - because it
- what do platelets do when they contact a damaged blood vessel wall? break/tear occurs in blood vessel wall, platelets adhere to site and release chemicals, released chemicals attract more platelets, platelet plug forms

February 5, 2017

- heart is a dual pump system
- heart contraction creates a pressure gradient (a different type of diffusion)
- left ventricle has a thicker muscular wall— this is to pump blood farther (pressure in left ventricle is higher)
- memorize the flow of blood through the heart
- diastole = relaxed (fill)
  - ventricular diastole = AV valves open
  - semilunar valves are closed
- systole = contracted (pump)
  - AV valves close
  - semilunar valves upen
- during diastole blood flows from atria into the ventricles
- we spend the most time on atrial and ventricular diastole

- only a short time on atrial systole
- know the equation: hear rate = heart beats/minutes and SV = ml ejected/beat

February 6, 2018

- make sure to understand what chordae tendinae do
- conduction cells (not neurons— they have been modified to send electrical signals): large diameter —> fast electrical signal and lack myofibrils
- depolarization signal is sent all the way to the bottom before spreading up and actually depolarizing heart muscle cells
- it goes down to the bottom because the heart squeezes from the bottom up and propels all the blood that needs to exit out the top
- how can we prevent the electrical signal from going down and straight through the heart
    - muscle cells are separated by a fibrous skeleton (collagen connective tissue) which separates the atria and ventricles
    - they allow the pause between contraction— important because the adjacent chamber needs a second to fill up (contraction goes from atria to ventricles)
- both ventricles contract at the same time— they both have the same volume (to maintain the pressure gradient) also, but different thickness of muscular walls
- both atria contract at the same time
    - this means blood is sent to the lungs and the body at the same time
- muscle cell action potential is different because a rapid influx of calcium occurs instead of the sodium, but everything else is the same (sodium still brings us up to threshold— funny [slow] Na+ channels— open anytime the cell is below threshold)
    - we often refer to these cells as not having a true resting potential
- how do cardiac and skeletal muscle differ?
    - skeletal muscle is straight, cardiac muscle is branched (bc whole contraction from many angles/branches which communicate with one another)
    - also, there are calcium channels which let extracellular calcium into the heart cell when the sarcoplasmic reticulum reservoir… what… calcium gated (influx triggers) calcium channel
    - stronger contraction = more calcium = more myosin heads bound = needs more calcium (channels open)
    - gap junctions: in the case of the heart, if you depolarize the first muscle cell, it will transmit the signal through all of the cells (to depolarization) every time— the gap junction is a literal hole in between two cells, which allow ions to pass
    - it is wiggly at the gap junction because it increases surface area

February 7, 2018

- in atrial fibrillation, there are too many P waves, and symptoms may include fatigue

February 8, 2017

- HP = hydrostatic pressure (pushes out)
- OP = osmotic pressure (pulls in)
- HP - OP = net change
- hyper-osmotic = high osmotic pressure (pulls water toward it)
- hypo-osmotic = less draw of water toward it
- arteries = pressure reserve (can constrict and stretch)
- veins = volume reserve (hold 60% of the blood in our body)
- skeletal muscle pump (muscle contraction for local pressure gradients— one way valves prevent it from moving down), respiratory pump (when we breathe, we create positive and negative), and peristaltic contractions of smooth muscle in veins
- varicose veins = failure of one way valves (allow blood to seep back through, warped valve, thin wall of vein, dilated vein, irregular blood flow, skin protruding)
- hypertension, obesity, and pregnancy increase rate of varicose veins
- atherosclerosis = causal for obstructive coronary artery disease
    - coronary arteries = supply to the heart tissue itself
    - excess LDL (cholesterol) enters arterial walls, macrophages eat LDL, macrophage —> "foam" cells
    - smooth muscle —> foam cells, more smooth muscles invades, fibrous cap forms, stiffer and narrower walls raise resistance to blood flow
    - inflammatory chemicals digest cap over plaque, there is a rupture which induces a blood clot
    - but there's no signal for the blood to get broken down, so the blood clot breaks loose and travels around body until it finds the narrowest place to stick (often the coronary arteries)
- baroreceptors (pressure receptors) used to regulate blood pressure— look at the loop in slides
    - baroreceptors work based on stretch (high = more stretch, low = less stretch)
- parasympathetic only effects the atria (relax muscles so basically just need to stop stimulating them)
- sympathetic deals with many more things (can constrict the diameter
- autonomic regulation of the heart
- sympathetic innervation can make heart rate increased and the strength of the contraction increased
- for sympathetic, increase heart rate, so increase rate of funny sodium channels and open more calcium channels to make depolarization faster and you need potassium channels to work faster too because it must re-polarize more quickly
- cross-bridge cycling is also important to speeding up heart rate— myosin need energy to affect calcium re-uptake to continue a circular process
- parasympathetic mostly affects potassium channels for hyper-polarization, no substantial affect on calcium channels for parasympathetic

- how does blood flow change during exercise?— overall flow rate changes (is increased), but the brain stays constant

- brain stays constant because of vasoconstriction (increases local resistance to maintain blood flow rate to brain)
- hemorrhage— low blood pressure triggers sympathetic nervous system which makes you lose blood faster and then you die
- don't need to study the kidney

- high blood pressure connected to baroreceptors means less receptor sensitivity —> increased risk for coronary artery disease
- jaundice
    - bilirubin (the causative material of jaundice)
    - spleen responsible for break down of red blood cells —> bilirubin
    - if something is wrong with your liver, it can't bind up bilirubin
    - or even if it does bind up there might not be a way
    - look at the three types of jaundice

Study:
- plasma is mostly water, some organic/inorganic molecules
- normal hematocrit a bit less than 50% red blood cells

February 13, 2018

- leukocytes (white blood cells)
- come from hemocytoblast (multipotent hematopoietic stem cell)

- goal: inactivate or destroy pathogens, abnormal cells, and foreign molecules without destroying yourself (this is pretty hard)
- anaphylaxis is cells not being specific enough and being to aggressive in response
- must balance specificity and aggression
- 1. see it (recognize invader is self vs. non-self), be specific
- 2. fight it (have appropriate response, be aggressive (not too little, not too much)

- the lymph system improves likelihood of identification: nodules and lobes
    - tonsils, thymus, spleen, leukocyte, reticular fibers
    - lymph tissue is spongey, loose-connective network
- having concentrated "ID checkers" makes it a better chance that lymphocyte will identify a bad microbe
- remove tonsils if they obstruct airway
- when pharyngeal tonsils swell up, might have hearing trouble or feel pressure or even lead to ear infection
- tonsillitis happens because the mouth is such a common point for contact with pathogens

- spleen
- deals with both white cells and red blood cells (phagocytes remove old red blood cells)
- white blood cells filter pathogens out of blood
- sickle cell leads to spleen damage because it can overload the process for removing red blood cells
- it's easy to rupture the spleen because, and hemorrhaging caused because the spleen stores reservoir of blood for emergencies
- a ruptured spleen is removed— too hard to repair because of the reticular fibers (loose connective tissue really hard to sew back together)

February 20, 2018

- telomerase (refills torn off part of telomeres,which are needed for cell division)

- stage 0 = abnormal cells
- stage 1 = localized cell mass growing that is cancerous
- stage 2 = spreads from one tissue type to another tissue type
- stage 3 = moves to lymph nodes
- stage 4 = moves through lymph nodes to other organs throughout the body
- metastasis = cancerous cells invade blood/lymph nodes

- theoretically (and realistically), our immune system should be able to identify cancer, but when a tumor/cancer cell displays antigens, a dendritic cell should activate immune system destruction, but in rare mutations, cancer cells can hide from immune system

- risk factors for cancer
- getting older and lots more— just look at slides
- adipose tissue promotes cancer because of hypoxia because of inflammation because of insulin resistance (look at slide)

- anatomical dead space is the volume of air in our respiratory system that never participates in gas exchange (in trachea, etc.)
- other thing is when air does do gas exchange, but doesn't leave (stays in alveoli)