Fitness and Health

* Food, water, and supplements
  + Water
    - Is considered to be a nutrient even though it has no calories
    - It is important to stay hydrated; dehydration makes pituitary gland release vasopressin
      * Vasopressin makes the kidney nephrons reabsorb water back into the bloodstream
        + Reabsorption of water means less urination
        + Urine contains toxic urea from breakdown of proteins
        + Less urination allows urea to build up in bloodstream, which is toxic to kidneys
        + Less urination means urine gets concentrated with more urea and also yellow urochrome from breakdown of oxygen-carrying heme
        + Less urination also makes sodium build up in blood, leading to high blood pressure
      * Dehydration generally leads to dark urine from high urochrome concentration
      * Dehydration can be self-diagnosed by dark urine and dry tongue
      * Creatine is a supplement which helps build muscle mass and risk dehydration by making you urinate more
  + Carbohydrates
    - Sucrose (table sugar) is digested, producing glucose and fructose
      * Glucose is blood sugar
        + Glucose is used to produce NADH in the citric acid cycle, which is then used to produce the ATP necessary for all cells to stay alive
        + Excess glucose is stored in the liver as glycogen, a branched glucose polymer
        + Insulin produced by the pancreas is produced in response to high blood sugar levels
        + Insulin tells the liver to absorb some blood sugar and turn it into glycogen
        + High insulin levels cause you to store fat and cause hardening of the arteries; this can damage blood vessels in the retina and cause diabetic retinopathy (blindness)
        + The liver breaks down glycogen and releases glucose into the bloodstream when blood sugar levels are too low
        + Too much glycogen in the liver causes the liver cells to swallow their insulin receptors and refuse to acknowledge insulin (insulin resistance)

Insulin resistance causes a stressed-out pancreas to produce more insulin; eventually this causes damage to pancreas leading to type 1 diabetes

High blood sugar which doesn’t respond to insulin is known as type 2 diabetes (may eventually develop into type 1 diabetes)

Type 1 diabetes requires daily insulin injections for a person to stay alive

* + - * Fructose is fruit sugar
        + The overwhelming majority of fructose is metabolized by the liver
        + The liver turns fructose into glucose (blood sugar), acetyl CoA (enters into citric acid cycle), and fat (triglyceride)
        + Too much fat in liver made too quickly leads to fatty liver disease, then to cirrhosis (which is irreversible), and eventually death
        + HFCS (High Fructose Corn Syrup) used to sweeten foods is currently thought to be unhealthy for this reason
    - Lactose (milk sugar) is a disaccharide made of glucose and galactose
      * Most adults have lost the ability to produce the lactase necessary to break down lactose into glucose and galactose
        + This is known as lactose intolerance
        + Lactose intolerance shows up when adults eat ice cream and other dairy products (like cheese or milk)
        + Lactose intolerance generally causes diarrhea
      * Galactose is a sugar found in some foods like kiwi, plums, ginger, and avocados
  + Fats
    - Animal fats are “saturated;” have no C=C double bonds
    - Vegetable fats (oils) are “unsaturated;” have one or more C=C double bonds; currently believed to be healthier than animal fats
    - Fats are made from glycerol, CH2(OH)CH(OH)CH2(OH), a trialcohol, and three fatty acids (fats are triesters because alcohol + carboxylic acid → ester)
    - Two unsaturated fatty acids are essential (must be obtained in diet)
      * α-Lineolic acid (ALA), an ω-3 fatty acid, C18:3Δ9,12,15
      * Linoleic acid (LA), an ω-6 fatty acid, C18:2Δ9,12
    - Two unsaturated fatty acids are almost essential (body doesn’t make much, and should be obtained in diet)
      * Eicosapentaenoic acid (EPA), an ω-3 fatty acid, C20:5Δ5,8,11,14,17
      * Docosahexenoic acid (DHA), an ω-3 fatty acid, C22:6Δ4,7,10,13,16,19
      * Both of these are important in manufacturing neurons in brain and nerves; they are found in cold-water fish like salmon and mackerel, and in seaweed
    - Vegans can get all of these in supplements; look for ALA, LA, EPA, and DHA in supplement ingredient lists
    - Antagonists block receptor sites that hormones bind to or make hormones less effective; example antihistamines block histamine receptors
    - Fatty acids from fats can be converted into ATP in mitochondria if blood sugar is low; gluconeogenesis in liver can convert glycerol into blood sugar
    - Excess fat is stored in adipocytes (fat cells)
  + Vitamins
    - A, D, E, and K are fat-soluble
      * All fat-soluble biochemicals (lipids) metabolize in liver
      * A builds up in liver and is toxic
        + Will cause fatty liver disease, then cirrhosis
        + Should not be supplemented
      * D is deficient in most people; should be supplemented, but only in recommended amounts
      * E should probably be supplemented also, but also only in recommended amounts; has antioxidant properties
      * K2 (called MK-7) can be supplemented in recommended amounts
        + Helps avoid buildup of coronary artery plaques containing calcium
        + Is not the same as K1
        + K1 should not be supplemented as it can cause blood clots in excess
    - B and C are water-soluble
      * These wash out of the body quickly (in urine) if larger doses are taken
      * C is important in helping fight pathogens, especially viruses
      * B vitamins are a collection of different vitamins collectively known as “B complex”
        + These are necessary for making nucleotides; important for creation of red blood cells, which have a limited lifetime
        + Also help the body produce energy, especially for neurons (like brain cells)
        + Original vitamins F, G, H, I, and J were renamed as B vitamins
  + Minerals
    - Categorized into micronutrient and macronutrient classes
    - Micronutrient minerals more toxic than macronutrient minerals
      * Do not supplement micronutrients Fe, Cr, Se, V, or B
      * Fe poisoning (liver toxin) from Fe supplementation is common
      * Zn, Mn, and Mo are micronutrients, but not as toxic as Fe, Cr, Se, V, and B
      * Zn probably should be supplemented in recommended amounts (antiviral), but not Mn or Mo
    - Macronutrient minerals not as toxic as micronutrients
      * Some of these should be balanced with other nutrients
        + Na+/K+ should be balanced; supplement K+ if you eat a lot of salt (Na+)
        + Zn2+/Cu2+; can supplement Cu2+ if you supplement Zn2+, but only in recommended doses (it is quite toxic to liver)
        + Vitamin D/Ca2+; vitamin D helps you absorb Ca2+
      * Macronutrient minerals are Na+, K+, Mg2+, Ca2+, Cl–, P, and S
  + Energy drinks: main problem is excess caffeine
  + Other supplements
    - Do your research; some are toxic; most are ineffective, but some do actually work
    - Scientists are actually studying these; a new field is developing called “functional medicine” complete with dedicated journals
    - A blistering array of supplements exist; many or most probably unnecessary if you eat well
      * Recommended diet is now daily consumption of a dark green vegetable (broccoli, spinach, etc.), a red or orange vegetable (tomatoes, carrots, etc.), protein (meat, fish, beans, etc.), fiber (popcorn, beans, nuts, etc.), fruit (apples, grapes, oranges, etc.), and at lease 8 cups of water (juice, tea, etc.)
      * Sugar and white starch are probably unnecessary and possibly unhealthy in excess
* Weight
  + BMI (Body Mass Index) is a measure of how healthy your weight is given your height
    - Formula: BMI = (weight in Lb/height in inches2) x 703
    - Best way to determine your BMI is to Google “BMI calculator” online
      * BMI < 18.5 is “underweight”
      * 18.5 < BMI < 25 is “normal”
      * 25 < BMI < 30 is “overweight”
      * 30 < BMI < 35 is “obese”
      * BMI > 30 is “very obese”
      * Healthiest weight is “overweight” but not “obese”
  + Belly fat may be better indicator of health than BMI
    - Current recommendation is waist < 40”
    - Current recommended fat levels
      * Men 10% - 20%
      * Women 20% - 30%
    - Can buy a fat measuring scale from Amazon for about $40
      * Fat has higher electrical resistance than other tissue
        + Fat not water soluble
        + Lack of water in fat means lack of electrolytes to conduct electricity
      * Fat measuring scale runs small electric current into one foot, up the leg, across the belly (containing fat), down the other leg, through the opposite foot, into the scale, and measures resistance
      * Measured resistance, weight, and height used by the scale to calculate body fat percentage
  + Exercise alone does not burn enough calories to result in weight loss
    - Only provable way to lose weight is calorie restriction and metabolism increase combined
    - Exercise can increase metabolism somewhat
    - Most supplements don’t work
    - Energy drinks (caffeine) raise metabolism somewhat
    - Amphetamines like Adderall raise metabolism significantly
    - Absent chemical intervention eat significantly less than 2000 calories/day to lose weight (2000 calories/day is about break-even)
    - 1 Lb of fat is equivalent to about 3500 calories (takes a long time to lose weight!)
    - Doctors recommend losing no more than 2 Lb/week
    - Losing 50 Lb should take about 6 months
    - Currently recommended is moderate exercise level
      * Get heart rate up to 100 beats per minute for 20 min/day 3 days/week
      * Can measure your pulse rate with a pulse oximeter, available from Amazon for about $15
      * Everything in medicine involves probability; moderate exercise supposedly reduces your probability of getting sick
  + Drugs
    - Caffeine
      * Caffeine has been found in multiple studies to be healthy in moderation
      * Currently recommended is less than 400 mg/day
      * 400 mg is roughly 3 cups of coffee, 6 cups of tea, 2 energy drinks, 10 dark soft drinks (ie, cola or Dr. Pepper but not root beer)
      * Caffeine consumed in coffee is thought to be extremely healthy, not so much for the caffeine but more for other nutrients in the coffee (like antioxidants)
    - Alcohol
      * Currently 1 drink/day (beer, glass of wine) is thought to be ideal dosage
      * 2 drinks/day is thought to be break-even
      * 3 or more drinks/day is thought to be more unhealthy than healthy
      * Continuous large excess long-term alcohol consumption leads to fatty liver disease, followed by cirrhosis (scar tissue in liver) followed by fulminant liver failure and death
      * Red wine is thought to be healthier than beer because red color is due to antioxidants; these are healthy in red wine for the same reason that they are in colored fruits and vegetables
    - Cannabis
      * Not as harmful as excessive alcohol consumption
      * Smoking cannabis increases lung cancer risk, but not as much as smoking tobacco, because cannabis contains some chemicals with mild anticancer properties
      * Long-term heavy use seems to be associated with increased risk of developing memory problems
    - Stimulants (Adderall and energy drinks)
      * Probably not too damaging in moderation
      * Can increase metabolism and help with weight loss
      * Excess caffeine from energy drinks can increase risk of developing heart arrhythmias, glaucoma (blindness), and osteoporosis (brittle bones)
      * Excess amphetamine (Adderall) consumption can cause brain hemorrhage, heart arrhythmias (like caffeine), and liver damage (amphetamine is fat-soluble, and everything which is fat-soluble is processed by the liver)
    - Hallucinogens (LSD, psilocybin mushrooms, peyote (mescaline cactus), ketamine, MDMA (Extasy or Molly), DMT)
      * Benefits: current research suggests that moderate usage can be beneficial; specifically these can improve neural network connectivity in brain (associated with intelligence), increase creation of new neurons, and help repair damaged neurons
      * Problems
        + MDMA causes some neuron damage which supposedly gets repaired, but is probably not good to consume for this reason
        + Although most people are not harmed by moderate hallucinogen use some people react very badly to them; they can be dangerous if not used extremely carefully and conservatively
        + Psilocybin mushrooms can be confused with poisonous mushrooms; for most people the correct mushrooms are probably harmless, but the ones sold on the street in chocolate may be contaminated with other substances
        + Ketamine is extremely toxic if used in excess; can cause severe CNS problems like coma, heart rhythm problems, seizures, breathing stoppage, dangerously low blood pressure, stopped heartbeat, etc.
        + DMT can cause serotonin syndrome (seizures, kidney failure, and respiratory failure) if used in excess
        + Virtually all hallucinogens are illegal; dealing with the criminal justice system is one of the most unhealthy things that you can experience
    - Drugs to avoid
      * Nicotine: extremely addictive, cardiovascular toxin, lung cancer risk in cigarettes
      * Opiates: addictive and toxic; fentanyl is the worst of these
      * Methamphetamine: addictive, causes brain damage
      * MDMA: does mostly reversible neuron damage in brain
  + Sun protection
    - Important; sun exposure can cause skin cancer and macular degeneration (blindness)
    - Moderate sun exposure (20 min/day) is more beneficial than harmful (helps promote natural vitamin D creation in skin)
    - UV-blocking sunglasses should be worn outdoors as there is no known benefit to sun exposure in the eyes; excessive exposure over time may lead to macular degeneration and blindness
    - Sunblock issues
      * SPF stands for Sun Protection Factor
      * UVB exposure = (time in sun/SPF); ideally combine time in sun with SPF level of a sunblock to give UVB exposure ≅ 20 min
      * Example: for SPF 30 sunblock 10 hours in sun gives UVB exposure = (10 hours/30 SPF) = 1/3 hour = 20 min (ideal)
      * If you spend 5 hr in the sun SPF 15 is ideal; anything above SPF 30 is probably overkill