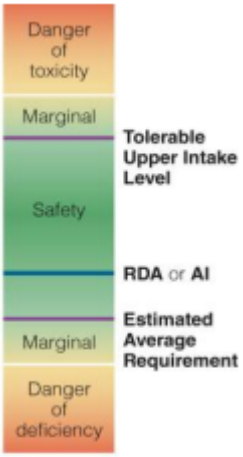
Lecture 1 – Nutritional Basics, Micronutrients

1. Outline the fundamental differences between fat soluble and water soluble vitamins, particularly as it relates to practical implications such as potential for losses prior to consumption, absorption and storage in the body.
    a. Fat Soluble (A, D, E, K)
        i. Found in foods containing fat
        ii. Fat presence needed for absorption
        iii. Excess can be stored in body (cannot be excreted in urine; more likely toxic)
            1. Stored in liver & fatty tissue
            2. Deficiencies take much longer to develop
    b. Water Soluble (B, C)
        i. Very sensitive to heat (lost during cooking evaporate into air)
        ii. Most excess can be excreted from body in urine (less likely toxic)
            1. All are easily excreted in urine except B12
            2. deficiency symptoms can develop quickly (a few days)
2. Describe the proper understanding of the various categories of the DRIs: RDA, AI, UL
    a. Dietary Reference Intake (DRI)
        i. Standards defined for:
            1. energy nutrients
            2. other dietary components
            3. physical activity
        ii. Applies to healthy people, may be different for specific groups
    b. Nutrient level categories of DRI
        i. Estimated Average Requirement (EAR)
            1. meets needs of 50% of population within each group
        ii. Recommended dietary allowance (RDA)
            1. meets needs of 95% of population within each group
            2. EAR + margin of safety
        iii. Adequate intake (AI)
            1. similar to RDA but signifies the "absence of definitive data on which to base an RDA"
        iv. Tolerable Upper Intake Level (UL)
            1. NOT recommended intake level
            2. Maximum level not likely to pose health risks for most healthy people
    c. Daily values based on RDAs/DRIs for essential nutrients (including vitamins) & Daily Reference Values
        i. Percentages based on 2000 kcal diet



3. State the importance considerations relative to mineral bioavailability in general, and with respect specifically to calcium, iron, and zinc
    a. major minerals: >100mg/day >.1% body weight; Calcium, phosphorus, magnesium, sodium, potassium, chloride
    b. trace minerals: <100 mg day present >.1% body weight; iron, zinc, copper, manganese, selenium
    c. Ultratrace: <1 mg/day; iodine, fluoride, chromium, molybdenum
    d. Competition at intestinal brush border for absorption
    e. cannot be destroyed by heat, air ,acid, or mixing

Mineral	Considerations	Bioavailability
Calcium (major)	1. Blood calcium levels 2. Plasma levels increased at expense of bone (Vit. D, PTH, Calcitonin) (All adults lose bone with age beginning bw 30-40 yo 3. Higher fracture risk with reduced GI pH (w/ PPIs) Most abundant mineral in the body 1-2% of adult body weight	- Cauliflower, watercress, cabbage (>50% absorption) - Yogurt, milk, cheese, sardines (higher content, ≈30% absorbed) - Spinach rhubarb swiss chard less than 5% absorbed -Almonds, seeds, beans, sweet potatoes about 20% absorbed
Iron (trace)	1. Hb 2. Stored as Ferritin (small intestine) 3. Transported via Transferrin 4.Very common deficiency 5.Body conserves iron and balance is maintained through absorption (absorb more when body is low) 6. Need depends on age, health, and iron status 7. RDA women >50 and men is 8mg RDA women 19-50 18 mg	- Heme iron (more bioavailable than non-heme) Iron cookware confers nonheme iron - Spinach, lentils, beef, sunflower seeds, bread, broccoli - Absorption enhancing: MFP, Vitamin C, some acids & sugars - Absorption inhibiting: phytates, polyphenols, vegetable proteins, calcium

Zinc (trace)	1. Most abundant intracellular trace element 2. In over 300 different enzymes 3. Absorption varies (due to mineral-mineral interactions w/ iron and copper) 4. Transport via albumin & transferrin 5. RDA 8 mg women, 11 mg men	- Beef, crab, yogurt, lentils - Sunflower seeds, spinach, whole wheat bread -Phytate inhibits absorption

4. Outline deficiency state/high risk groups and potential toxicity for Vitamin A, D, E, K, C, thiamin, niacin, riboflavin, B12, and folate

Vitamin	Key Functions	Food Source	Deficiency States/High Risk Groups
A	1. Growth, Development, and Reproduction: Growth activating protein synthesis 2. Maintenance of Epithelial Tissues: mucus production 3. Immune Function: deficiency leads to infection 4. Vision (retinal)	Beef liver, carrots, spinach, mustard greens, apricots, eggs, milk	-Can arise when there is fat malabsorption -Risk of infectious diseases -Night blindness (xeropthalmia) (dry eyes due to lack of mucous→ infections) -Keratinization and hyperkeratosis -Change in size and shape of epithelial cells→ dry scaly skin + GI problems affecting nutrient absorption + weakened defenses in respiratory, urinary tracts, and vagina -Death
D	1. Bone Growth 2. Enhances or Suppresses Gene Activity 3. Immunity	Salmon, milk, eggs, cheese, liver	- Children: Rickets (bending of bones) - Adults: Osteomalacia and eventually osteoporosis - Elderly at risk: low sun exposure, dietary intake, and organ function decline - Diseases and Surgery: Fat malabsorption from lower GI, Liver and Bariatric Surgeries -40 deg latitude or above b/c of less sunlight -Men with deficient levels are 2X more likely to have MI -Cardiovascular disease higher risk of MI and CVD death with low levels -Higher blood pressure -Multiple sclerosis linked to low levels
E	1. Antioxidant in chronic disease 2. heart disease: inhibit oxidation of LDL	plant oils?	-toxicity is rare - high doses interfere with Vit K activity 2ndary def -Abeta lipoproteinemia (ABL): interferes with absorption, abnormal growth, spine curves, balance and dexterity problems -fat malabsorption from hepatobiliary and intestinal diseases, and bariatric surgery symptoms: CNS (ataxia and peripheral neuropathy) Effects: erythrocyte hemolysis/hemolytic anemia, neuromuscular dysfunction
K	1. Clotting and Coagulation 2. Metabolism of Bone Proteins: Osteocalcin needs Vit K, otherwise bones become brittle	mainly leafy vegetables mustard greens, kiwi, and soybean oil	- Primary deficiency is rare - Secondary: fat malabsorption and some drugs that disrupt vitamin K synthesis/ action (like blood thinners) and antibiotics which kill gut bacteria which help us get our vit K - Newborn Infants need Vit K injections because they have sterile guts - High risk individuals: High intake/doses can reduce the effectiveness of anticoagulant drugs -Consistency in intake is key get 50% from gut and 50%diet

C	1. Cofactor in Collagen Formation 2. Hydroxylates Carnitine 3. Converts Tryptophan to Serotonin 4. Converts Tyrosine to NE 5. Hormone Synthesis 6. Antioxidant (protects tissues from oxidative stress) 7. Important in stress and released with stress hormones from adrenal gland	Fruits and vegetables, potatoes, broccoli, spinach	- Scurvy: gums bleed, hemorrhages in subcutaneous skin, psychological signs, and sudden death - Smoking: increases need for Vitamin C - Interferes with medical regimens/ drugs like angioplasty and statins, niacin, warfarin, aspirin, and chemotherapy
B12	1. Brain, Nervous System, and Blood Formation 2. DNA Synthesis and Regulation 3. Fatty Acid Synthesis 4. Required for Iron Absorption	Trout, beef, pork, milk, cheese, chicken, orange juice -Vegan diets require supplementation - more available from animal products (almost exclusive source)	- Deficiency >15% among older adults - Atrophic Gastritis - Fatigue, Poor appetite, mucosal and skin pallor, difficulty concentrating - Megaloblastic Anemia (pernicious anemia) -High folate masks the B12 Deficiency, but neurologic symptoms continue - Bariatric Surgery and Diseases of the Small Intestine (Crohn's) - Vegans
B9 (Folate)	1. THF: Transfers single-carbon compounds during metabolism (primary coenzyme form THF) 2. Converts B12 to coenzyme form 3. DNA synthesis 4. Regenerates Methionine from Homocysteine	Lentils, spaghetti, asparagus, spinach	- Linked to CVD via homocysteine metabolism -Autism and neural tube defects in babies -Impairs cell division: red blood cells and anemia -GI tract deterioration due to impaired protein synthesis -Sensitive to heat, oxidation -Primary deficiency: sensitive to heat, oxidation Synthetic form more bioavailable than natural form -Secondary deficiency from drugs
Riboflavin	Coenzyme in energy metabolism; maintenance of skin and visual function	Stable when heated destroyed by UVR and alkali	- newborns w/hyperbilirubinema receiving phototherapy have higher needs - symptoms: photophobia, tearing, blurring, burning lips, magenta tongue, cheilosis, peripheral neuropathy, cataract and other deficiencies Toxicity: unknown effect
thiamin	Coenzyme in energy metabolism; maintenance of appetite and nervous system function		Dry Beriberi:Affects nervous system; Occurs w/ energy deprivation and inactivity wet beriberi: Affects cardiovascular system; Occurs w/ high CHO intake and strenuous exertion -Common in areas consuming polished rice and raw fish - Antithiamin factors inactivate by oxyreductive mechanism, destroys thiazole ring : Thiaminases in raw fish; Polyhydroxyphenols in coffee, tea, blueberries, black currants, brussels sprouts, red cabbage: Vitamin C can prevent the reaction D. -Bariatric surgery (as soon as 2 wks post-op),long-term diuretic use E. -Alcoholism: Decreased intake; Increased need (liver damage); Decreased absorption in proximal SI, inhibited by EtOH -causes wernicke and Korsakoff syndrome

Niacin	Coenzyme in energy metabolism; maintenance of skin, nervous and digestive systems		Deficincy: Pellagra (3D's) -dermatitis, diarrhea, dementia -Malnutrition, anorexia nervosa, alcoholism, dialysis, cancer, HIV/AIDS pts, Crohn's disease, Hartnup's disease (genetic disorder causes defect in tryptophan absorption), Carcinoid syndrome (increased serotonin secretion w/ increased tryptophan for synthesis of serotonin vs niacin

5. Outline the key functions, at least 3 significant food sources, and deficiency states/high risk groups for the minerals calcium, iron, phosphorus, iron, and zinc

Mineral	Functions	Food Source	Deficiency States/High Risk Groups
Calcium	1. Participates in Blood Clotting (extracellular) 2. Nerve Transmission 3. Muscle contraction 4. Blood Pressure Regulation 5. Release of Hormones	Yogurt, 1 % milk, cheese, sardines	- Osteoporosis - Atrophic Gastritis: Acid required for absorption - Estrogen Deficiency - Vitamin D Deficient -most likely to be deficient - Female - Cigarettes - Alcohol chronic disease links to -CVD -Diabetes -obesity -colon cancer
Iron	1. Hb 2. Cofactor for oxidation-reduction reactions 3. Electron Carriers	Spinach, lentils, beef, sunflower seeds, bread, broccoli	- most common deficiency world wide (80% population) - Iron Deficient Anemia (Hb cannot be produced)→ red blood cells become microcytic and hypochromic -Lethargy and weakness -can arise from: inadequate intake, blood loss, or disease -Stages: Iron stores diminish (serum ferritin), decrease in transport iron (transferrin), and iron deficiency (hemoglobin and hematocrit values) - Vulnerable: women in reproductive years, pregnancy, infants and young children, and adolescence -Link to disease as a catalyst for oxidation (heart disease and cancer)
Zinc	1. Gene expression 2. Blood Clotting 3. Cell Membranes 4. Immune Fct. 5. Growth and Development 6. Synthesis, Storage, and release of Insulin 7. Thyroid Hormone Function 8. Behavior and Learning Performance 9. Visual Pigment 10. Taste Perception 11. Sperm Production 12. enzymes (300 dif types; including superoxide dismutase)	Beef, crab, yogurt, lentils, sunflower seeds	- Hypogonadism - Short Stature - Impaired Immune Response - Delayed wound healing - Impaired Taste Acuity - Damage to CNS - Alopecia, skin lesions

Magnesium		Green leafy vegetables, unrefined grains, legumes, beans, nuts	- nausea, muscle weakness and cramping, mental derangement, changes in BP/heart rate, disrupt ca/vit D metabolism toxicity: Nausea, muscle weakness and cramping, mental derangement, changes in blood pressure and heartbeat - toxicity conditions: Diuretics, antacids, laxative abuse, parenteral nutrition, Mg therapy for premature labor or eclampsia, kidney failure, diabetic ketoacidosis, hypothyroidism, Addison's, ingestion of excess seawater
Copper		legumes, whole grains, nuts, shellfish, seeds	-deficiency symptoms: anemia (microcytic), skeletal abnormalities, hair/skin depigmentation -high risk: intentions diseases (celiac) Toxicity: supplements, Wilsons disease, kayser fleischer ring around iris
chromium	1. Carbohydrate, lipid, protein metabolism 2. Potentiates insulin action	- oysters, liver, brewer's yeast, potatoes	deficiency: diabetes like conditions
Selenium		soil, meats, fisk, milk, grains, eggs , brazil nuts	deficiency: no obvious symptoms - thyroid disease; cardiomyopathy -monogolia: Kashin-beck disease in adolescents (finger pain, swelling, osteoarthritis) Toxicity: skin, nail changes, tooth decay, GI distress, neurological abnormalities

6. Identify the types of individuals/groups who may need nutrient supplementation
    - Specific nutrient deficiencies
    - low energy intakes
    - vegans
    - Older adults with atrophic gastritis
    - lactose intolerance
    - certain medications
    - certain stages of life cycle (pregnancy)
    - inadequate milk intake, sun exposure, or dark skin
    - medical conditions that interfere with nutrients in the body

7. For the various age groups (infants, toddler-aged children, adolescents), identify the most common nutrient deficiencies or specific nutrients likely to present concerns
    f. Ca, Mg, K, Vit E, fiber are of concern
    g. Infants: vitamin D, iron
    h. toddler-aged children: vitamin D, iron
    i. adolescents: vitamin D, Ca, Mg, K, Vit E, Fiber
        i. Most common is Ca
        ii. Fe for females can be a concern
        iii. Bone density: often have low ca/ vit D and K, Cu, Mn, Zn, P are not in proper ratio.

8. Define nutrient density as it relates to foods and identify the reason why a more nutrient dense diet is warranted as people age.
    j. More vitamins, minerals, & protein per calorie *ex. 100 Cal= 2.5c of broccoli which has vit c, iron, protein and fiber compared to 100 Cal= 8oz soda which has no nutrients at all
    k. "Superfoods"
    l. nutrient dense diet is higher in nutrients and lower in energy—> helps prevent obesity and chronic diseases
    m. fewer calories with more nutrients and phytochemicals (can help fight chronic disease and increases antioxidant intake; In aging, need a more nutrient dense diet to prevent weight gain

Lecture 2: Nutritional Assessment – Width

1. Describe the purpose of and differences between Nutrition Screening and Nutrition Assessment, and discuss the 4 categories covered in a nutrition assessment
    a. Nutrition Screening
        i. Quick, easy and include data that is readily available
        ii. May be done by a health care professional and paraprofessionals, don't necessarily need trained nutritionist
        iii. Quickly identify people at nutritional risk who may need comprehensive nutritional assessment

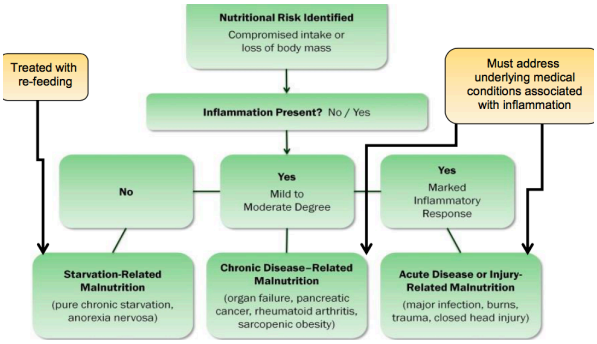
iv. Utilizes weight, diet, skin integrity, appetite, GI disturbances, dentition

b. Nutrition Assessment
   i. Comprehensive, evaluates problems, needs, status, and used in formulating treatment plan
   ii. 4 Categories
      1. Anthropomerics: physical measurements for determining body composition
      2. Biochemical: blood & urinalysis (protein status mainly)
      3. Nutrition-Focused exam: look for clinical nutrition risk factors
      4. History: PMH/SH for nutritional relevance

2. Describe the symptoms, complications and treatment of Kwashiorkor and Marasmus
   a. Kwashiorkor: condition that results primarily from protein deficiency
      i. Children weaned off breast milk ⇒ high carbohydrate diet low in protein (acute)
      ii. Symptoms: edema, fatty liver (lipids remain in liver because proteins for signaling not being processes), patch and scaly skin, loss of hair and skin pigment, stunted growth, muscle wasting
   b. Marasmus: primarily from protein deficiency (chronic PEM, protein energy malnutrition)
      i. Symptoms: severe muscle wasting, stunted growth, impaired learning ability, low body temp, lethargy, GI tract atrophy
      ii. Chronic effects of protein malnutrition and body adaptation
   c. Complications
      i. Degradation of antibodies: prone to infection
      ii. Dysentery: diarrhea
      iii. Anemia
      iv. Combination of infections, fever, fluid imbalance, and anemia can lead to heart failure and death
   d. Treatment
      i. Rehydration and nutrition intervention: add protein slowly
      ii. Antibiotics help with recovery

Features of Kwashiorkor & Marasmus in Children	
Kwashiorkor	Marasmus
Seen in children 12-18 months-3 years	Seen from infancy to any age
Inadequate protein intake, typically with adequate or high CHO intake	Severe deprivation of energy, protein, vitamins, minerals
Rapid onset	Develops slowly over time
Some weight loss; Some muscle wasting with retention of body fat	Severe weight loss; Severe muscle wasting, with no body fat
Growth: 60-80% wt-for-age	Growth: <60 weight-for-age
Edema and fatty liver	No detectable edema or fatty liver
Apathy, misery, irritability, sadness	Anxiety, apathy
Skin becomes discolored and develops lesions	Skin is dry, thin, easily wrinkles
Hair is dry, brittle, pulls out easily, changes color, become straight	Hair is sparse, thin, dry; pulls out easily

3. Differentiate between the three types/categories of malnutrition based on etiology, and state the 6 criteria used for identification/diagnosis of malnutrition in adults
   a. Severe muscle wasting
   b. Severely stunted growth
   c. Impaired learning ability
   d. low body temperature
   e. Lethargy
   f. GI tract atrophy



4. Calculate ideal body weight using the Hamwi method, including adjustments for frame size, amputation, and/or spinal cord injuries (adjustment factors for amputation or spinal cord injuries would be given but know the formula for IBW and how to make adjustments)
   a. Females = 100 lbs. for 5 feet + (5 lbs/inch over 5 feet)
   b. Males = 106 lbs. for 5 feet + (6 lbs/inch over 5 feet)
   c. % IBW = $\left(\frac{Current\ Weight}{Ideal\ Body\ Weight}\right) \times 100$
   d. Adjustments:
      i. Frame Size: measure wrist circumference distal to the styloid process on the left hand and compare to chart
         1. Subtract 10% from IBW for small frame
         2. Add 10% to IBW for large frame
      ii. Amputation:
         1. $\left(\frac{100 - \%\ amputation}{100}\right)(IBW\ for\ original\ height)$
         2. Paraplegia: subtract 5-10% from IBW
         3. Quadriplegia: subtract 10-15% from IBW

Percentage Body Weight Contributed by Body Part	
Hand	0.7 %
Forearm and hand	2.3%
Entire arm	5.0%
Foot	1.5%
Lower leg and foot (below knee)	5.9%
Entire leg	16.0%

   e. Adjusted Body Weight: based on the assumption that 25% of excess weight is metabolically active lean body mass and 75% is metabolically inert adipose tissue; used by many clinicians for a patients >120 %IBW (although not evidence based)
      i. $Adj\ BW = (CBW - IBW)0.25 + (IBW)$

5. Discuss the purpose and cautions of using Body Mass Index (BMI) in nutrition assessment
   a. Diagnosis of obesity

International Classification of Adult Underweight, Overweight & Obesity (World Health Organization)		
Category	BMI (kg/m²)	Obesity Class
Starvation	< 15.0	
Underweight	< 18.5	
Normal	18.5 – 24.9	
Overweight	25.0 – 29.9	
Obesity	30.0 – 34.9	I
	35.0 – 39.9	II
Extreme Obesity	≥ 40	III

b. Originally intent was actually for population studies not individual
c. Does not take into account muscularity, frame size, bone proportions, cartilage, water weight
d. For all ages, separate for children

6. Describe the purpose of the different methods of evaluating body weight changes in hospitalized patients when completing a nutrition assessment (%IBW, % weight change). Calculations would be given if used in a question
   a. % IBW: tells you how far off a person is from their ideal weight, but nothing about current weight status
   b. Weight change: a more meaningful parameter to assess weight change
      i. $$\%\ Weight\ Change = \left(\frac{Usual\ BW - Current\ BW}{Usual\ BW}\right)100$$

Time	Significant Loss	Severe Loss
1 week	1 – 2 %	> 2 %
1 month	5 %	> 5 %
3 months	7.5 %	> 7.5 %
6 months	10 %	> 10 %

      ii. Can pick up on involuntary weight loss: burn victims, spinal injury rehab, outpatient rehab post injury/surgery, and nursing home patients
         1. consider the hydration status, which can falsely affect actual weight: edema and ascites
      iii. Adjusted Body Weight: based on the assumption that 25% of excess weight is metabolically active lean body mass and 75% is metabolically inert adipose tissue; used by many clinicians for a patients >120 %IBW (although not evidence based)
         1. $Adj\ BW = (CBW - IBW)0.25 + (IBW)$
         2. Used when patient is >120% IBW
      iv. Skin fold and arm measurements
         1. Widely used technique for estimating body composition
         2. Used more often in outpatient and community settings but useful in determining malnutrition in a clinical setting
         3. Principle: amount of total body adipose well represented by subcutaneous fat (50%)
         4. Inexpensive and non-invasive
         5. Sites include triceps, subscapular, suprailiac
         6. Provides data on adipose stores and is a good indicator of muscle and protein reserves
         7. You measure: midarm circumference MAC and triceps skin fold TSF
         8. You calculate: arm muscle area (AMA) AMA= $[MAC - (3.14 \times TSF)]^2 / 4 \times 3.14$
         9. Compare to standards. Serial measurements work best to monitor changes
      v. Waist circumference and waist to hip ratio
         1. Presence of excess fat in the abdomen, out of proportion to total body fat is a risk factor for heart disease and diabetes
         2. Waist circumference= measure waist at the top of the hip bone level with the navel
            a. >35 inches (88cm) for a woman, >40 inches (102cm) for a man is considered high risk
         3. waist to hip ratio: measure hip circumference at widest pt. then divide waist circumference by hip circumference.
            a. Below .8 women
            b. Below 1.0 for a man
7. Describe which biochemical tests are used to assess protein status and anemia in a nutrition assessment
   a. Protein status: nitrogen balance, pre albumin and albumin (previously used)
   b. Anemia: hemoglobin, hematocrit, mean cell volume
8. Identify the 3 types of nutritional anemias
   a. Iron:
      i. hypochromic (low mean cell Hb), microcytic (low mean cell volume)
      ii. most common cause of anemia worldwide
   b. cobalamin B12 (pernicious anemia)
      i. normochromic (normal MCH), macrocytic (high MCV)
      ii. Malabsorption due to loss of intrensic factor from GI disease, bariatric/gastric surgery
   c. Folate
      i. normochromic (normal MCH), macrocytic (high MCV)
      ii. very rare in US
   d. folate and B12 deficiency hard to differentiate
   e. Therefore, if iron and B vitamin deficiencies coexist, values may be normal (further tests needed)
9. Discuss common drug-nutrient interactions (warfarin, MAOIs, problems with grapefruit juice)
   a. Warfarin:
      i. Monitoring INR/PT (clot formation times) and consistency in vitamin K intake is ESSENTIAL
      ii. Sudden increases in vitamin K intake can decrease effectiveness of warfarin; sudden decreases can increase effect
      iii. Need to limit high vitamin K foods to 1 serving/day
         1. Raw: kale, parsley
         2. Boiled: spinach, turnips, collards, Swiss chard, mustard greens

iv. Need to limit moderate vitamin K foods to 3 servings/day
    1. Raw: spinach, turnips, green leaf lettuce, broccoli, romaine, endive
    2. Boiled: brussels sprouts
v. Avoid alcohol and caution with herbal supplements
    1. Increase warfarin effects: garlic, ginger, ginko, feverfew
    2. Decrease warfarin effects: ginseng

b. MAOIs:
    i. MAO (monamine oxidase) is an endogenous enzyme in the GI tract that normally metabolizes pressor vasoactive amines (VA,tyramine), keeping them at safe levels
    ii. MAOI drugs suppress MAO increasing the sensitive to tyramine and possibly precipitating hypertensive crises
    iii. MAOI are a class of antidepressants & prescribed less frequently & when patient is not responsive to other treatment

c. Grapefruit Juice:
    i. Can block hepatic enzymes that normally metabolize drugs, enhancing the drug action
    ii. Examples of Drugs Affected: anti-anxiety, anti-arrhythmia, anti-convulsants, antidepressants, antifungals, anti-histamines, antiretrovirals, anti-seizures, calcium channel blockers, immunosuppressant's, impotence drugs, statins

10. Describe the different methods available to estimate energy, protein and fluids needs (equations and factors would be given if needed)
    a. Energy Needs
        i. Indirect Calorimetry is the gold standard
            1. measures oxygen consumption VO2 and carbon dioxide production VCO2
            2. calculates the resting energy expenditure (REE)
            3. metabolic cart:
            4. advantages: portable, practical, eliminates variability and prediction errors
            5. disadvantages: requires constant calibration
        ii. Med Gem (hand-held)
            1. Uses sensors to measure O2 consumption and calculates resting metabolic rate (RMR)
            2. Option in outpatient
            3. Still questioning accuracy (studies)
        iii. Harris-Benedict Equation
            1. measures resting energy expenditures and is not very accurate
            2. Total Daily Energy Expenditure = TDE x AF (activity factor: sedentary vs. ambulatory) and/or SF (stress factor: burns, sepsis, surgery, trauma)
        iv. Calories per kilogram
            1. Fast and easy to use
            2. Uses actual or ideal body weight (if patient >120% IBW use IBW vs actual)
            3. Normal= 25-30 kcal/kg
            4. stress (mild)=30-35 kcal/kg
            5. stress (moderate-severe)= 35-45

Fluid Needs

Body Weight	
Young active (15 – 30 years)	40 mL/kg
Average (25 – 55 years)	35 mL/kg
Older (55 – 65 years)	30 mL/kg
Elderly (>65 years)	25 mL/kg
Energy Intake	
1 mL/kcal for adults	
Body Surface Area	
1500 mL/M^2	

Protein Needs: based on actual body weight

DRI, healthy adult	.8 g/kg
Normal-maintenance	0.8-1.0
Metabolic stress – mild	1.2-1.5
Metabolic stress-moderate to severe	1.5-2.0
Protein depletion-mild to severe based on albumin levels	1.2-2.0

Lecture 3: Maternal and Infants, Children, Adolescents – Reinhard

1. Identify the cut off points for BMI (normal, overweight, obesity)

children (precentile)		Adult	
underweight	<5th	Healthy weight	20-24.9
Healthy weight	5th - 85th	overweight	25-29.9
overweight	85th-95th	class 1 obesity	30-34
obesity	≥ 95th	class 2 obesity	35-39.9
		class 3 obesity	≥40

2. Select the long term effectiveness of weight loss maintenance (based on data from national institutes of health)
    a. If 10% of body weight is lost:

        i. 66% regain all in 1 year
        ii. 95% regain all in 3-5 years
3. State the traditional guideline for recommended rate of safe weight loss for adults (pounds per week)
    a. 1-2 lb/week
4. Identify the waist circumferences for males and females associated with higher disease risk
    a. Male >40
    b. Female: >35
5. Describe characteristics of the American lifestyle that contribute to the toxic environment obesity theory and also to eating disorders (anorexia nervosa and bulimia nervosa); outline the role of the cultural ideal and restrained eating with respect to the toxic environment theory
    a. Availability and type of foods
        i. fast food
        ii. high fat and energy, low fiber and nutrients
    a. Less Energy Expenditure:
        i. Low energy cost to obtain food
        ii. Appliances have reduced energy cost for daily routine
        iii. Hunter gatherer cultures vs the US
        iv. Chewing gum and the importance of NEAT as well as intentional physical activity
        v. Coach potato: there is an app for tracking TV viewing; rewards for TV time and the phone rewards can be scanned at places like burger king and starbucks
    b. Increased Portion Size
    c. Societal Attitudes Against Obesity
        i. Biggest Loser effect: after viewing subjects actually have more negative views towards obese individuals; lower BMI subjects has highest aversion
        ii. Employment Discrimination: hiring discrimination, lower salaries for overweight workers (women 6.2%, men 2.3% lower)
        iii. Physician Discrimination: doctors more compassionate to thinner patients
        iv. Weight Teasing in Adolescence: Predicts disordered eating at 5 yr follow up
    d. Eating Disorders: cultural ideals affect body image and begin the cycle of restrained/disordered eating; can lead to eating disorders
        i. Obsession with diet, exercise and weight loss attempts coexist with the highest prevalence of obesity
        ii. Cultural standards for beauty have changed
6. Identify the correct protocol for physicians as per the NHLBI expert panel: 2013 guidelines for management of overweight & obesity in adult (data collected, frequency); state the cut off point for treatment/ intervention of obesity and overweight
    a. 1998: BMI 30 or higher, BMI of 25 + 2 comorbidties
    b. 2013: BMI 25 + 1 comorbidity + high WC
    c. Treatment: lifestyle (diet, exercise, therapy)
7. state the current guidelines for consideration of bariatric surgery (BMI without other comorbidities)
    a. BMI $\geq$ 40 (class 3 obesity) without comorbidity
    b. BMI of 35 or class 2 obesity higher with two comorbidities
    c. BMI < 30 if diabetes or metabolic syndrom
8. as part of the guidelines, identify the optimal components of a comprehensive bariatric program
    a. Diagnosis, assessment, long term follow up, Team (MD, RD, exercise specialist, barbaric nurse, psychologist)
9. Outline the recommendation for total weight gain during pregnancy based on prepregnancy weight (Institute of Medicine Recommendations 2009)

    Maternal Weight Gain

Category	**BMI**	**Weight Gain (lbs)**
Underweight	< 18.5	28 – 40
Normal	18.5 – 24.9	25 – 35
Overweight	25 – 29.9	15 – 25
Obese	$\geq$ 30	11 - 20

10. state the BMI cut off for underweight in pregnancy and the risk associated with levels below the cut off
    a. BMI < 18.5 = high risk of low birth weight
11. Select the BMI categories (percentiles) from the National Center for Health Statistics for children related to overweight and obesity
    a. BMI Assessment in Children:
        i. Obesity: 95th percentile and up
        ii. Overweight: 85th-95th percentile

iii. Underweight: less than 5th percentile

12. From the research of Brian Wansink regarding the "mindless margin" identify the average excess consumption (as a percentage) with the endless soup bowl study
    a. 73% more
13. Based on current lifestyle recommendations and comparing to various profiles, select an appropriate physician role model for his or her patients
    a. Physicians who lead healthy lifestyle

Lecture 5: Diabetes – Width

1. Describe the risk factors and the warning signs/symptoms for type 1 and type 2 diabetes

	Type I	**Type II**
Risk Factors	- No Major Risk Factors - But their is an environmental and genetic role	- Genetic disposition (strong family history) - Age (>40 yrs) - Ethnicity: American Indian, AA, Mexican American, and Pacific Islander - Obesity - Sedentary lifestyle - Low birth weight: lower birth weight association (fetal programming) - Diet: high saturated fat, low fiber/high CHO
Warning Signs/Symptoms	- Very rapid onset that worsens over days/ weeks - Polyuria, polydipsia, polyphagia, -fatigue, weakness, weight loss (noticeable) , and blurred vision -glycosuria occurs when renal threshold exceeds 180/200 mg/dl	- Usually worsen over weeks, months, or years - Polyuria and polydipsia - Fatigue and weakness - Frequent infections and/or slow-healing sores - Neuropathy - Gradual weight loss (less noticeable than type I) - Acanthosis Nigricans - present in flexural areas - insulin overproduction; spills out into skin
Characteristics	- Have a thin to normal body weight - Initial onset is in children and adolescents -need exogenous insulin -autoimmune destruction of pancreatic beta cells -5-10% of diabetes cases	- Blurred vision is the result of microvascular disease - >85% of diabetes cases -insulin resistance -onset usually >40 yrs of age -Treated with healthy diet, exercise, oral meds, and/or insulin -insulin resistance may improve with weight reduction and/or drug treatment

2. state the factors (screening parameters) that put people at higher risk for developing diabetes

Type I	Type II	Gestational diabetes mellitus
-genetics -environmental triggers	- need to have a genetic predisposition - age -ethnicity (AA, mexican, asian american, native america, Hawaiin, pacific islander) -obesity sedentary lifestyle -Diet: high in saturated fat, low in fiber/high carbohydrate	- obesity - advanced maternal age - family history of diabetes - GDM in previous pregnancy - ethnicities at risk of diabetes

3. Describe the laboratory tests used for diagnosis of diabetes, and identify the diagnostic criteria for pre-diabetes and diabetes using the fasting plasma glucose and A1C tests (do not need to know OGTT values for diagnosis)
    a. HbA1c:
        i. no fasting required
        ii. Not recommended for children
    b. Fasting Plasma Glucose (FPG)
        i. 8-12 hour overnight fast

ii. preferred for non pregnant adults and children

c. Oral Glucose tolerance Test
   i. One or two step strategy
   ii. used in pregnancy

d. Random Casual Blood glucose
   i. Not the preferred diagnostic tool
   ii. Must be >200 w/ obvious and significant signs of diabetes

	Fasting Plasma Glucose (mg/dl)	A1C (percent)
Diabetes	126 or above	6.5 or above
Prediabetes	100 to 125	5.7 to 6.4

4. Identify the most common nutritive and nonnutritive sweeteners and their effects on the blood
   a. Nutritive
      i. Sucrose (Table Sugar)
         1. May be substituted for another CHO
         2. Still must count and cover by insulin or meds as necessary
      ii. Fructose
         1. Occurs in fruits and vegetable
         2. Less affect on postprandial BG than Sucrose
         3. May have adverse effects on plasma lipids (can increase TGs)
         4. Avoid added fructose in processed/packaged foods (60% of daily intake)
      iii. Sugar Alcohols
         1. Half the calories of sucrose
         2. Sorbitol, mannitol, xylitol, isomaltose
         3. May cause diarrhea and GI discomfort
         4. Still have calories; but may be only half metabolized (not considered "free food")
   b. Non-Nutritive
      i. Acesulfame-K (Sweet One)
      ii. Aspartame (equal, Nutrasweet)
      iii. Saccharin (sweet 'N Low)
      iv. Sucralose (Splenda)
      v. Neotame (newtame)
      vi. advantame (general purpose)
      vii. Stevia (SweetLeaf, Truevia, PureVia)
      viii. luo han guo fruit extracts
      ix. All considered safe for people with diabetes when consumed at ADI levels established by the FDA
      x. Still can cause weight gain and increases in blood sugar
5. Outline the major dietary recommendations for fat, protein and fiber in diabetes
   a. Fat
      i. Want 25-35% of total calories to come from fat; about 55-75 grams total
      ii. Low-End: those who are overweight, obese, have metabolic syndrome, or those with abnormal lipid profiles
      iii. High-end: well-controlled patients with good lipid profiles and normal weight
      iv. Limit Saturated fats <7% of total calories
      v. Limit Trans fats < 1%
      vi. Choose fats from mono- and poly-unsaturated sources: nuts, seeds, fish, and vegetable oils
      vii. Keep cholesterol under 200 mg per day
   b. Protein
      i. Same requirements as general population: 10-20 % of total calories: 50-100 g/day
      ii. Low End: well-controlled patients with good protein stores and normal weight
      iii. High End: Poorly controlled, newly diagnosed, overweight/obese, and those with metabolic syndrome
      iv. usually these patients are hyper-catabolic
      v. patients with diabetes at risk for kidney disease
   c. Fiber
      i. Evidence is truly lacking
      ii. DRI for women= 25g, men= 38g; average US intake is 14g
      iii. May improve glycemic control, reduce hyperinsulinemia, decrease plasma lipids
         1. hard to take in 50g though, mainly because of palatability and GI side-effects
      iv. Should tell patients to aim for 25-30g per day
         1. 10g from grains and cereals (whole grains, oatmeal, fiber cereals)
         2. 10g from fruits and vegetables (raspberries, blackberries, guava, pears w/ skin artichokes, lima beans, brussels sprouts)
         3. 10g from legumes, nuts, and seeds: all beans, almonds, pistachios
         4. drink plenty of water to avoid constipation
6. Describe Carbohydrate Counting, and know which food groups are considered carbohydrates. Calculate the number of carbohydrate choices allowed given a total daily calorie level. Know specifics regarding fiber and carb counting
   e. Carbohydrate Counting

i. 1 CHO Choice = 15 grams of CHO (starch, milk, fruit, other)
ii. 4 kcal/g CHO

f. grains, starchy vegetables, fruits, juices, milk, yogurt, sweets, desserts, non starchy vegetables (carrots, broccoli)
g. Use Exchange Lists or Food labels to determine CHO grams
   i. Total kCals x 0.55 (the percentage of calories coming from CHO during the Day) = # kcals from CHO
   ii. #kcals from CHO/ (4 kcals/g CHO) = # g of CHO per day
   iii. # g of CHO per day/ 15 g/carbohydrate choice = # of carbohydrate choices
   iv. 55% C, 20% P, 25% fat (percentage of calories from 3 groups)
h. CC and Fiber
   i. If a food contains > 5 grams of fiber, subtract half of fiber grams from the total CHO to get the available CHO
i.

$$CHO\ Choices = \left(Total\ kcal \times 0.55\ (\%\ cal\ \ from\ daily\ CHO)\right) \times \left(\frac{g\ CHO}{4\ kcal}\right) \times \left(\frac{CHO\ Choices}{15\ g\ CHO}\right)$$

7. Describe glycemic response, index, and load. Calculate glycemic load
   j. Glycemic Response: varying response of blood glucose and insulin to different types of carbohydrates; affected by food form, degree of ripeness of fruits
   k. Glycemic Index: the rise in blood glucose following ingestion of a food as a percentage of the rise that follows a control food (glucose or white bread)
      i. Issue: no standardized list of GIs
   l. Glycemic Load: ranking system for CHO content in food portions based on glycemic index and the portion size (most useful because it takes this into account)
   m. Glycemic Load= net CHO x glycemic index / 100
   n.

$$Glycemic\ Load = \frac{net\ CHO \times Glycemic\ Index}{100}$$

8. Identify the uses of Insulin-to-Carbohydrate Ratio and Insulin Sensitivity/Correction Factor and be able to use them in a calculation
   o. Insulin-to-CHO Ratio: the amount of insulin needed to cover a specified number of CHO grams
      i. "500 Rule": 500 divided by the total daily dose (TDD) insulin, which equals all basal plus bolus insulin
         1. Example: TDD=40 units, 500/40=12.5, therefore insulin-to-CHO ratio is ~1:13
         2. So, eat 60 g CHO/ 13= 4.5 units of insulin to cover the meal
      ii. Note: use 500 for rapid acting insulin and use 450 for regular insulin
   p. Insulin Sensitivity/ Correction Factor: the mg/dL drop in blood glucose caused by 1 unit of insulin
      i. "1700 Rule":
         1. Correction factor= 1700/TDD
         2. Example: TDD=35 units, 1700/35= 48.5 (CF= ~50mg/dL)
         3.

$$Correction\ Bolus = \frac{\left(Current\ BG - Goal\ BG\right)}{Correction\ Factor}$$

      ii. Note: use 1700 for rapid acting insulin and use 1500 with regular insulin
9. Outline the causes, symptoms and treatment of hypoglycemic shock
   q. Causes
      i. BG < 70 mg/dL
      ii. Missing a meal, excessive insulin or oral meds, prolonged duration or increased intensity of exercise, alcohol intake without food, or vomiting/diarrhea
   r. Symptoms
      i. Sweating, Impatience, Double Vision, hunger, pallor, trembling, palpitations, headache, faintness
      ii. May lead to mental confusion or unconsciousness
   s. Treatment: 15/15 Rule
      i. Take 15 g CHO and Check BG after 15 minutes; repeat if necessary
      ii. Usually 4-5oz soda regular or fruit juice;3-4 packs, tsp, cubes of sugar; 5-6 pieces of hard candy; 3-4 tsp cake frosting; 3 glucose tablets

Lecture 6: Cardiovascular Disease (CVD) – Khosla

1. State the main risk factors for CVD (gender, age, blood lipids, other diseases, etc).
   a. Major Changeable Risk Factors:
      i. High blood cholesterol
      ii. Smoking
      iii. Hypertension
   b. Other Risk Factors:
      i. Genetics (family history)

ii. Male (females actually have a higher rate of CHD than men after menopause)
iii. Age (males > 44, females > 54)
iv. Diabetes
v. Obesity
vi. Low HDL (<40)
vii. High triglyceride
viii. Inactivity
ix. Personality, stress, coping

2. Select the apolipoproteins associated with higher and lower risk for CVD (i.e. A – E)
    a. Apo A: found in chylomicra (A-I, A-IV) and HDL (A-I, A-II); protective
    b. Apo B-100: found in VLDL, IDL and LDL; bad (atherogenic)
    c. Apo E: found in VLDL and IDL; bad (atherogenic)
    d. Note: different phenotypes for LDLs (phenotype A is large and low CVD risk while phenotype B is small and has a high CVD risk)
3. Identify the diseases for which high waist circumference increases risk
    a. CVD
    b. Type II diabetes
    c. Gall bladder disease
4. Outline the dietary fat sources for monounsaturated fat, polyunsaturated fat, and saturated fat
    a. MUFA: canola oil, olive oil and peanut oil, soybean oil
    b. PUFA: safflower oil, sunflower oil, corn oil and soybean oil (n-6 FAs)
    c. SFA: mostly animal products (butter, beef fat, lard); palm oil (but not atherogenic; actually good for blood lipids), palm kernel oil, and coconut oil
5. Identify which dietary fat sources should be recommended based on risks from blood lipid levels
    a. PUFAs
        i. Lowers LDL & HDL
    b. Fish & Plant n-3 PUFAs
        i. Lowers AA synthesis and improves hemodynamics
        ii. Dilation of blood vessels, prevent platelet aggregation
        iii. Lower enzymes that convert AA to LT
        iv. Reduces blood viscosity
        v. Reduces blood pressure
        vi. Reduces triglycerides
        vii. Counteract proliferative vascular response to atherogenic stimuli at the lesion level
        viii. Reduces the number of small size LDL particles
    c. N-6 PUFAs
        i. Potent vasoconstriction and platelet aggregation
    d. MUFAs
        i. Lowers LDL, but does not lower HDL
        ii. Also improve LDL resistance of oxidation compared to SFA and CHO
    e. SFA (saturated fatty acid)
        i. Reduction lowers LDL & HDL
        ii. Not sure if benefit or harm
    f. Monounsaturated > Saturated FA
        i. But are all associated with either no increased risk of CVD (SFA) or lowering the risk of CVD (MUFA)
        ii. Some evidence shows that PUFAs may raise the risk for CVD
    g. ALA (α-linoleic acid)
        i. Converted to EPA and DHA
        ii. Causes dilation of blood vessels and prevention of platelet aggregation
    h. Trans-Fats (Avoid)
        i. Increases LDL
        ii. Lowers HDL
        iii. Higher TC: HDL ratio
6. Select the fatty acids with the strongest evidence for protective effects against CVD
    a. raising HDL lowers CVD
    b. monounsaturated fatty acid
7. Based on the 2013 American Heart Association and American college of cardiology guidelines for CVD assessment, identify the 9 risk variables.

9 risk variables	Acceptable range	Ideal
Sex	M or F	
Age	20-79	
Race	AA or W/H	

Total Chol	130-320	170
HDL- chol	20-100	150
systolic BP	90-200	110
Treatment of HTN	Y/N	N
DM	Y/N	N
Smoking	Y/N	N

7. outline components of the DASH diet
    a. Normal BP and mild to moderate HTN; N = 460- 3 test diets
        i. high fruit/veg and high low-fat diary
    b. sodium not restricted, to 4g
    c. body weight not changes
    d. Significant reduction in BP; benefit for hypertensives and AA subjects
    e. Follow up: 3 levels of sodium
        i. decrease BP with each reduction in Na
        ii. current DASH diet is also lower in Na
8. identify major nutritional problems that may arise after a stroke
    a. Dysphagia: difficulty swallowing, choking, dehydration; temporary or permanent weight loss
    b. physical disability: eating (feeding oneself), physical activity reduction can cause weight gain
    c. Malnutrition us up to 50% of pts
    d. Ischemic CVA pts who are nutritionally compromised on admission more likely to become malnourished, have worse clinical outcomes
    e. additional calories (24) and protein (11g) resulted in significantly higher number of its to return home, had higher functional scores and an improved ability to walk.

Lecture 7: Evalutating Nutrition research - Cabelof

1. Be familiar with study design issues in nutrition science
2. list common reasons for nutrition misinformation
3. Identify the challenges of designing nutrition guidelines or giving nutritional advice in the face of equivocal data