

# Study Guide for NTR 306 Final

- One continuous, 75-minute attempt – Yes, it is timed!
  - SSD accommodations for extra time will be automatically added to your exam
- Approximately 40 questions
  - Multiple choice, matching, T/F, fill-in-the-blank
  - ~Half of questions are *application-based* (i.e., word problems)
  - Chapters 1-20 (*nothing from chapter 18*) – Yes, it is cumulative!
  - Open book: use class materials only (e.g., notes you have taken (or SSD notes), textbook/e-book, lecture slides, lecture videos, etc.) – NO internet searches! Please show academic integrity.
- 100 points

**\*\*\*This study guide does NOT contain every theme that will be on the midterm, nor will every theme in this study guide be tested.  
This is a *guide* – you are in control of your own preparation!\*\*\***



# Review concepts from Chapter 1-2

- Factors that influence food choices
- Six classes of nutrients:
  - Organic vs inorganic
  - Energy yielding vs non-energy yielding
    - kcalorie values of energy yielding nutrients
  - Macronutrients vs micronutrients
- Scientific Method
- Study Designs & Interpreting the Evidence



# Review concepts from Chapter 1-2

- Dietary Reference Intakes (DRI)
  - EAR, RDA, AI, UL
- Estimated Energy Requirement (EER)
- Acceptable Macronutrient Distribution Ranges
  - Carbohydrate, fat, and protein
  - Calculate daily kcalories/grams within AMDRs
- Nutrition information sources
  - Registered Dietitians
  - Analyzing information from different sources (e.g. internet)



# Review concepts from Chapter 1-2

- Diet-planning principles
  - Adequacy, balance, energy control, nutrient density, moderation, variety
- *Dietary Guidelines for Americans*
  - *Healthy Eating Index*
  - *Current Recommendations*
- USDA Food Patterns
  - Analyze meals for the six food groups and subgroups
  - Serving sizes and equivalent measures for six food groups and subgroups
- My Plate



# Review concepts from Chapter 1-2

- Food processing
  - Whole, fortified, minimally processed, ultra-processed
  - Grains: refined, enriched, whole-grain
- American dietary habits
  - Overconsumption and underconsumption of certain nutrients
- Nutrition labels:
  - Differences between claims on nutrition labels:
    - Nutrient claims, health claims, structure-function claims
  - Interpreting nutrition facts labels:
    - Finding serving size, calculating total kcalories, calculating kcalories from each of the major nutrient groups (e.g. fat, carbohydrates, protein), interpreting ingredients list, new labels vs old labels



# Review concepts from Chapter 3

- Digestive processes
  - Food's journey from ingestion to excretion (pathway through digestive organs and sphincters; transition from food to bolus to chyme to stool)
  - Muscular actions
  - Secretions: enzymes, juices, bile, mucus
    - pH changes throughout digestive processes
- Absorptive processes
  - Anatomy and pathways of nutrient absorption
  - Vascular system (i.e. bloodstream) vs lymphatic system
- Specific digestive and absorptive processes for energy nutrients
  - Fats, proteins, carbohydrates



#### MOUTH: CHEWING AND SWALLOWING, WITH LITTLE DIGESTION

**Carbohydrate** digestion begins as salivary amylase breaks down starch from bread and peanut butter.

**Fiber** covering on the sesame seeds is crushed by the teeth.

**Fat** digestion is minimal. Some hard fats melt as they reach body temperature.

**Protein** foods are moistened by saliva.



#### STOMACH: COLLECTING AND CHURNING, WITH SOME DIGESTION

**Carbohydrate** digestion ceases when the stomach acid of the gastric juices inactivates the salivary amylase.

**Proteins** from the bread, seeds, and peanut butter begin to uncoil when they mix with the gastric acid, exposing them to the gastric protease enzymes that break down proteins.

**Fat** from the peanut butter and seeds tends to separate from the watery GI juices.



#### SMALL INTESTINE: DIGESTING AND ABSORBING

**Carbohydrate** digestion picks up when the pancreas sends pancreatic enzymes to the small intestine via the pancreatic duct to break down starch. Enzymes on the surfaces of the small intestinal cells complete the process of breaking down starch into small fragments that can be absorbed through the cells of the small intestine walls and into the hepatic portal vein. Sugars from the banana require so little digestion that they begin to traverse the intestinal cells immediately on contact.

**Fat** from the peanut butter and seeds is emulsified by bile. Now pancreatic and intestinal lipases can break down the fat to smaller fragments that can be absorbed through the cells of the small intestine wall and into the lymph.

**Protein** breakdown depends on the pancreatic and intestinal proteases. Small fragments of protein are absorbed through the cells of the small intestine wall and into the hepatic portal vein.

**Vitamins and minerals** are absorbed.

*Note:* Sugars and starches are members of the carbohydrate family.

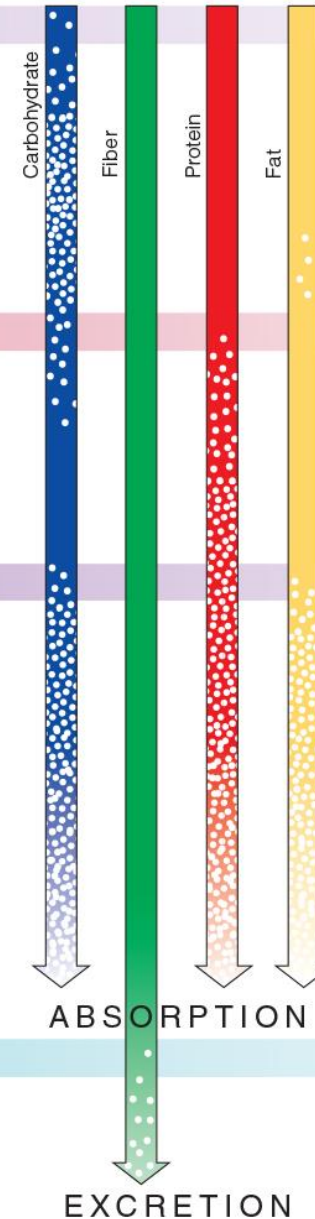


#### LARGE INTESTINE: ABSORBING AND ELIMINATING

**Fluids and some minerals** are absorbed.

**Some fibers** from the seeds, whole-wheat bread, peanut butter, and banana are partly digested by the bacteria living in the large intestine, and some of these products are absorbed.

**Most fibers** pass through the large intestine and are excreted as feces; some fat, cholesterol, and minerals bind to fiber and are also excreted.





## Review concepts from Chapter 3

- Digestive reactions: condensation vs hydrolysis
- GI microbiota functions
- GI hormone action and negative feedback loops
  - Gastrin, secretin, CCK
- Common digestive problems





## Review concepts from Chapter 4

- Soluble fiber:
  - Dissolving in water, gel formation (viscous), fermentation, and the ability to lower blood cholesterol
  - Examples: barley, oats, legumes
- Insoluble fiber:
  - Indigestible components of the diet that promote bowel movements, alleviate constipation and prevent diverticular disease
  - Examples: wheat bran, legumes, brown rice



# Review concepts from Chapter 4

- Carbohydrate characteristics and digestion:
  - Monosaccharides: glucose, fructose, galactose
  - Disaccharides: maltose, sucrose, lactose
  - Polysaccharides: glycogen, starch (amylose, amylopectin), fiber (soluble, insoluble)
- Carbohydrate digestion:
  - Mouth (salivary amylase)
  - Stomach (none)
  - Small Intestine, primary site (pancreatic amylase; maltase; sucrase; lactase)
  - Large Intestine (none); Fermentation
- Carbohydrate absorption:
  - Active transporters (glucose and galactose); Passive (Fructose)



# Review concepts from Chapter 4

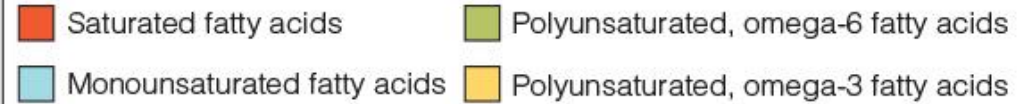
- Carbohydrate metabolism
  - Glucose storage (glycogen), use for immediate energy or stored as fat
  - Organ uses (Brain first, others second)
  - Glucose and hormone interactions:
    - Blood glucose rises (during/after meals): triggers release of insulin (moves glucose to cells to store excess) → blood glucose level is lowered
    - Blood glucose falls (between meals, overnight): triggers release of glucagon (moves glucose out of storage to fuel body) → blood glucose level is raised
    - Irregularities: Diabetes & Hypoglycemia
- Health impacts of carbohydrates and recommended intakes
  - Simple Sugars
  - Low/No calorie Sweeteners
  - Starches & Fibers

# Review concepts from Chapter 5

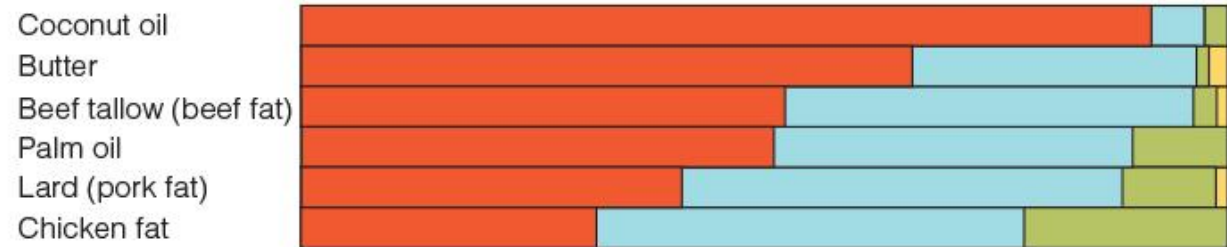
> **FIGURE 5-5**

Most fats are a mixture of saturated, monounsaturated, and polyunsaturated fatty acids.

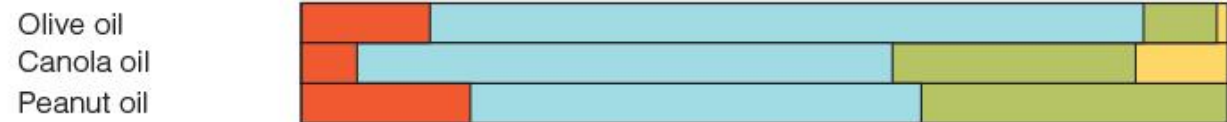
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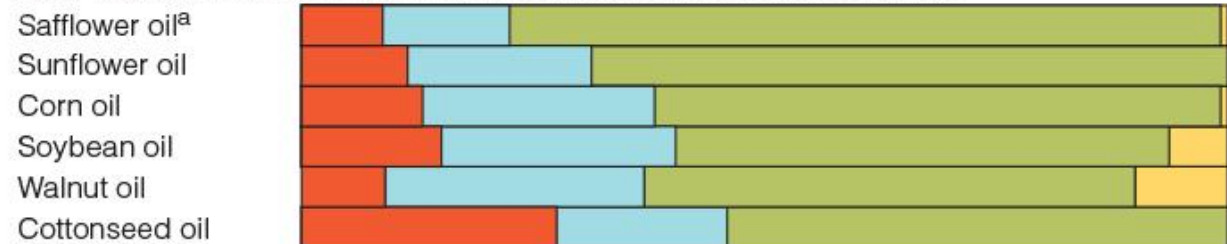
**Animal fats and the tropical oils of coconut and palm contain mostly saturated fatty acids.**



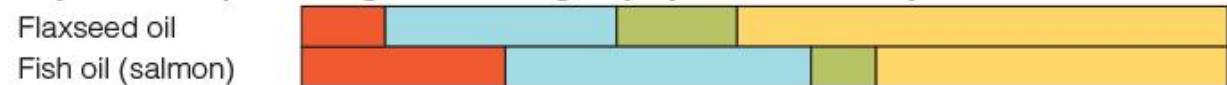
**Some vegetable oils, such as olive and canola, are rich in monounsaturated fatty acids.**



**Many vegetable oils are rich in omega-6 polyunsaturated fatty acids.**



**Only a few oils provide significant omega-3 polyunsaturated fatty acids.**



<sup>a</sup>Salad or cooking type over 70% linoleic acid.



# Review concepts from Chapter 5

- Degrees of unsaturation of fats: saturated vs monounsaturated vs polyunsaturated
  - Characteristics and molecular structures of each
  - Hydrogenation
  - Trans-fats
- Others: Phospholipid & Sterol characteristics
- Digestive pathways and absorption processes of lipids
  - Mouth (lipase); Stomach (lipase); Small Intestine, primary (Bile, Lipases)
  - lymphatic system to circulation (fat globules → micelles → chylomicrons → VLDL, etc.)
- Fat Metabolism
  - Circulating TG → FAs (muscle & adipose tissue use lipoprotein lipase)
  - Adipose TG → FAs (hormone sensitive lipase)
- Lipoprotein types, characteristics, and health implications
  - Dietary cholesterol vs blood cholesterol; TG vs Cholesterol

# Review concepts from Chapter 5

## Lipoprotein

1. Chylomicrons

2. VLDL

3. LDL

4. HDL

## Characteristic

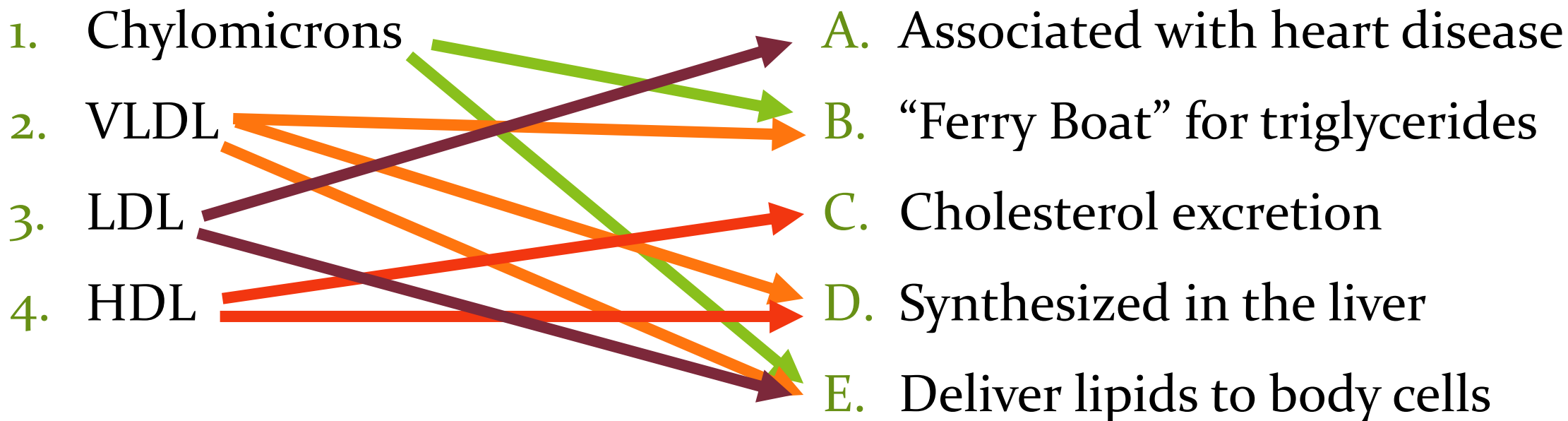
A. Associated with heart disease

B. “Ferry Boat” for triglycerides

C. Cholesterol excretion

D. Synthesized in the liver

E. Deliver lipids to body cells





## Review concepts from Chapter 5

- Fatty acids:
  - Linoleic vs linolenic
  - Omega-3 fatty acids vs omega-6 fatty acids
  - Essential, non-essential, conditionally essential
- Relationships between different fats and health outcomes
  - Chronic disease
- Metabolic changes due to dietary insufficiencies:
  - Low-carb diet
    - Gluconeogenesis



# Review concepts from Chapter 6

- Roles of protein in the body
- Amino acids
  - Essential, nonessential
- Protein digestion
  - Mouth (nothing)
  - Stomach (HCL, pepsin)
  - Small Intestine (proteases, peptidases)
- Protein absorption active transporters (AAs)
- Protein metabolism
  - Nitrogen balance
  - Amino Acid Pool
  - Urea production and excretion





# Review concepts from Chapter 6

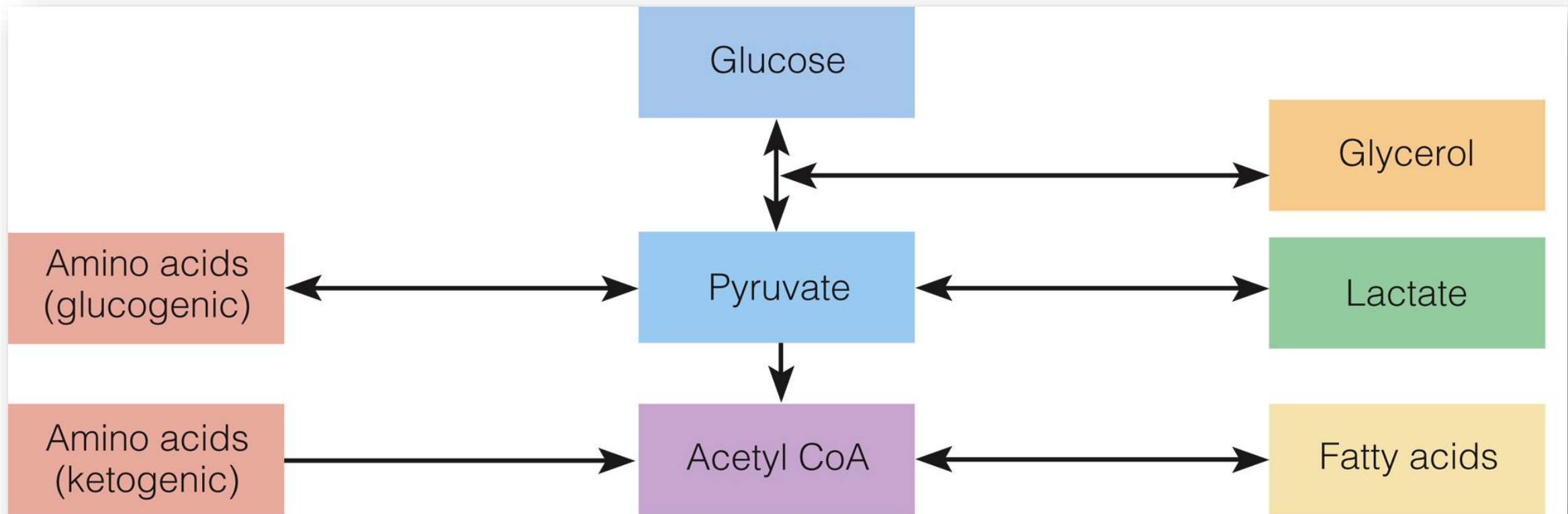
- Protein deficiency
- Protein & Health
  - No effects on CVD, T2D, or Cancer
  - Benefits for weight management, glycemic control, appetite control, satiety, performance
- Protein quantities
  - RDA vs. Optimal Amounts



## Review concepts from Chapter 7

- Reactions: catabolic vs anabolic
- Role of enzymes and coenzymes
- Metabolic compounds: Acetyl CoA and pyruvate
- Glycolysis (conversion of glucose to pyruvate)
- Pyruvate's options: lactate vs Acetyl CoA
  - Cori cycle
- Glycerol and fatty acid pathways
- Amino acid metabolic pathways

## Review concepts from Chapter 7



NOTE: Amino acids that can be used to make glucose are called *glucogenic*; amino acids that are converted to acetyl CoA are called *ketogenic*.

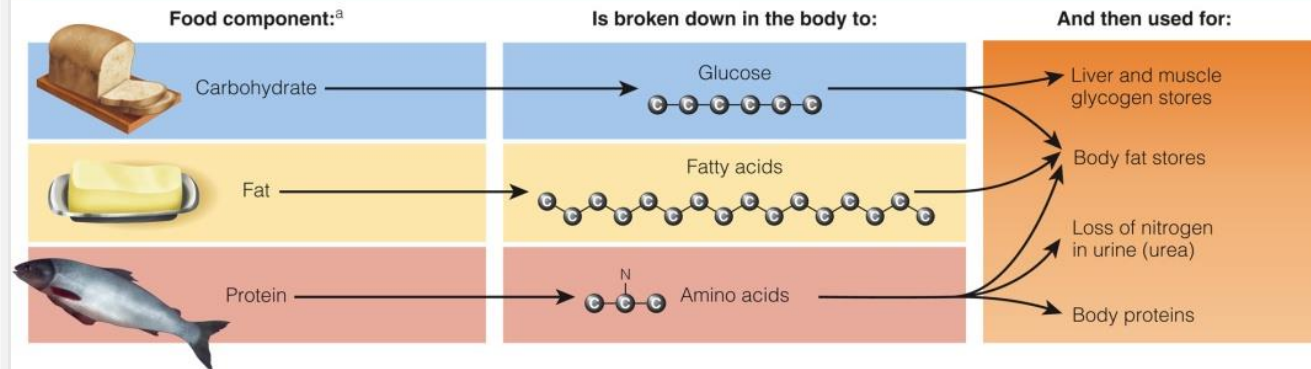


## Review concepts from Chapter 7

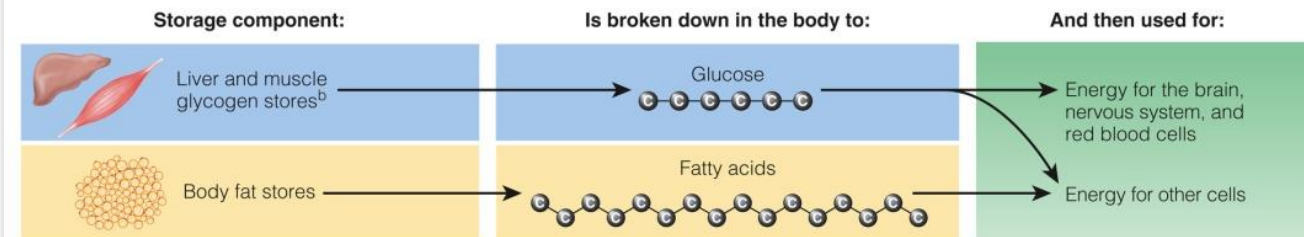
- TCA cycle
- Electron transport chain
- Metabolic processes of overconsumption of energy nutrients
  - Fat, carbohydrate, protein

# Review concepts from Chapter 7

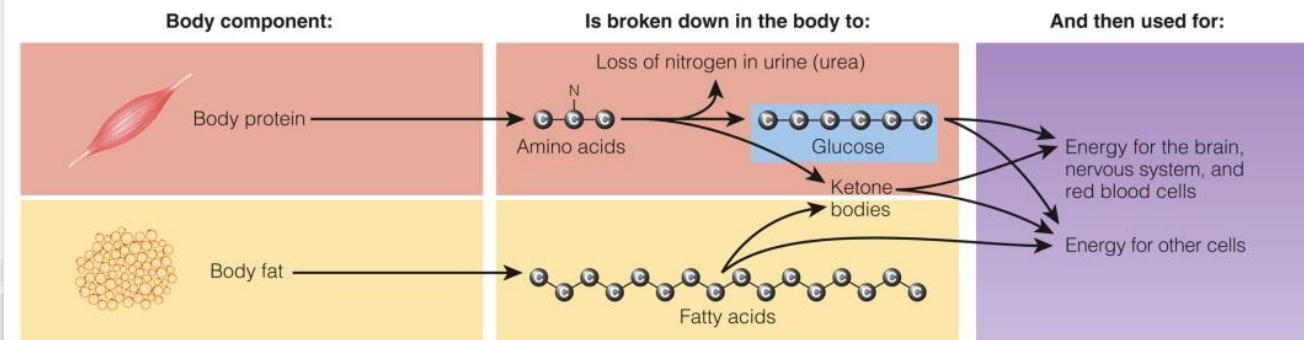
**A When a person overeats (feasting):** When a person eats in excess of energy needs, the body stores a small amount of glycogen and much larger quantities of fat.



**B When a person draws on stores (fasting):** When nutrients from a meal are no longer available to provide energy (about 2 to 3 hours after a meal), the body draws on its glycogen and fat stores for energy.



**C If the fast continues beyond glycogen depletion:** As glycogen stores dwindle (after about 24 hours of starvation), the body begins to break down its protein (muscle and lean tissue) to amino acids to synthesize glucose needed for brain and nervous system energy. In addition, the liver converts fats to ketone bodies, which serve as an alternative energy source for the brain, thus slowing the breakdown of body protein.



<sup>a</sup>Alcohol is not included because it is a toxin and not a nutrient, but it does contribute energy to the body. After detoxifying the alcohol, the body uses the remaining two carbon fragments to build fatty acids and stores them as fat.

<sup>b</sup>The muscles' stored glycogen provides glucose only for the muscle in which the glycogen is stored.



## Review concepts from Chapter 8

- Energy balance
- Hunger, satiety, and satiation vs Food Cravings & Reward
- Basal metabolism
  - Factors that affect BMR
  - Calculating BMR
- TEF
- Physical Activity and Non-exercise Activity Thermogenesis
- Estimating energy requirements
- BMI
  - Calculating BMI
  - Body types and BMI



# Review concepts from Chapter 8

- Body fat distribution
  - Waist circumference
  - Visceral vs subcutaneous fat
- Overweight and obesity
  - Health risks
  - Chronic disease



## Review concepts from Chapter 9

- Fat cell development and metabolism
- Hormones associated with body weight
  - Leptin vs ghrelin
- Treatments for obesity
- Weight loss strategies
  - SMART goals
- Weight maintenance and prevention of excessive weight gain



# Review concepts from Chapter 10

- Vitamins
  - Do not yield energy
  - Necessary for life functions
  - Grouped by solubility in water or fat
  - Bioavailability: amount present in food differs from amount absorbed/used by body

**TABLE 10-2 Water-Soluble and Fat-Soluble Vitamins Compared**

	Water-Soluble Vitamins: B Vitamins and Vitamin C	Fat-Soluble Vitamins: Vitamins A, D, E, and K
<b>Absorption</b>	Directly into the blood	First into the lymph, then the blood
<b>Transport</b>	Travel freely	Many require transport proteins
<b>Storage</b>	Circulate freely in water-filled parts of the body	Stored in the cells associated with fat
<b>Excretion</b>	Kidneys detect and remove excess in urine	Less readily excreted; tend to remain in fat-storage sites
<b>Toxicity</b>	Possible to reach toxic levels when consumed from supplements	Likely to reach toxic levels when consumed from supplements
<b>Requirements</b>	Needed in frequent doses (perhaps 1 to 3 days)	Needed in periodic doses (perhaps weeks or even months)

NOTE: Exceptions occur, but these differences between the water-soluble and fat-soluble vitamins are valid generalizations.



## Review concepts from Chapter 10 – 11

- Vitamin precursors: converted to active form in body
- Organic nature (C): easily destroyed by natural forces (e.g. heat)
- Excessive intakes can lead to toxicity – only certain vitamins
- Some vitamins act as coenzymes (especially B vitamins)
- Understand roles in the body, deficiency, toxicity, recommendations, food sources, and destruction for:
  - B vitamins: thiamin, riboflavin, niacin, biotin, pantothenic acid, B<sub>6</sub>, folate, B<sub>12</sub>
  - Vitamin C
  - Vitamin A and beta-carotene
  - Vitamin D
  - Vitamin E
  - Vitamin K

# Review concepts from Chapter 12

- Water's roles in the body
  - Electrolyte balance in cell fluid
    - Cations vs anions
    - Intracellular vs extracellular
  - Maintenance of blood volume
  - Acid-base balance
    - Lungs
    - Bicarbonate - carbonic acid
- Water losses, dehydration, and recommended intake

**TABLE 12-1 Important Body Electrolytes**

Electrolytes	Intracellular (inside cells) Concentration (mEq/L)	Extracellular (outside cells) Concentration (mEq/L)
<b>Cations (positively charged ions)</b>		
Sodium ( $\text{Na}^+$ )	10	142
Potassium ( $\text{K}^+$ )	150	5
Calcium ( $\text{Ca}^{++}$ )	2	5
Magnesium ( $\text{Mg}^{++}$ )	40	3
	202	155
<b>Anions (negatively charged ions)</b>		
Chloride ( $\text{Cl}^-$ )	2	103
Bicarbonate ( $\text{HCO}_3^-$ )	10	27
Phosphate ( $\text{HPO}_4^-$ )	103	2
Sulfate ( $\text{SO}_4^-$ )	20	1
Organic acids (lactate, pyruvate)	10	6
Proteins	57	16
	202	155

NOTE: The numbers of positive and negative charges in a given fluid are the same. For example, in extracellular fluid, the cations and anions both equal 155 milliequivalents per liter (mEq/L). Of the cations, sodium ions make up 142 mEq/L; and potassium, calcium, and magnesium ions make up the remainder. Of the anions, chloride ions number 103 mEq/L; bicarbonate ions number 27; and the rest are provided by phosphate ions, sulfate ions, organic acids, and protein.

# Review concepts from Chapter 12

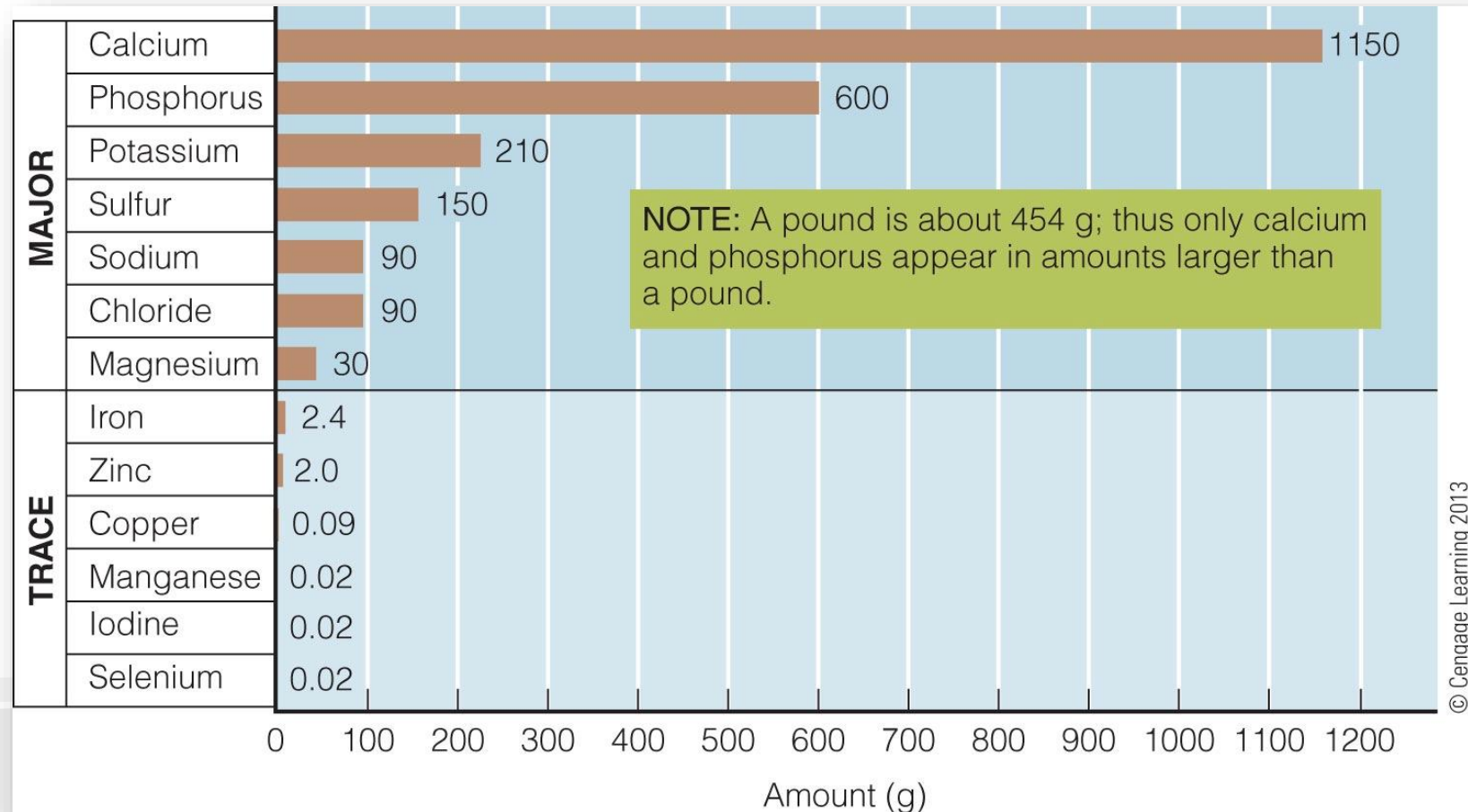
## ○ Minerals:

### ○ Major vs trace

### ○ Inorganic

- Can't be destroyed
- Can leach out and be lost in cooking water

### ○ Variable absorption, transport, roles in body, and bioavailability





## Review concepts from Chapter 12 – 13

- Understand roles in the body, deficiency, toxicity, recommendations, and food sources for:
  - Sodium
  - Chloride
  - Potassium
  - Calcium
  - Phosphorus
  - Magnesium
  - Sulfate
  - Iron
  - Zinc
  - Iodine
  - Selenium
  - Copper
  - Manganese
  - Fluoride
  - Chromium
  - Molybdenum
- Contaminant Minerals
- Phytochemicals



## Review concepts from Chapter 14

- Overload principle of fitness: increase in frequency, intensity, time
- Strength training vs endurance exercise: differences, benefits
- “Balanced” fitness programs
- Energy for fitness
  - Glucose use, storage, importance
  - Fat use
  - Role of protein
- Other nutrients of importance: vitamin E, iron, water



## Review concepts from Chapter 15

- Fetal growth and development stages
  - Critical periods
- Maternal weight gain: recommendations, implications, return to pre-pregnancy weight
- Nutritional needs: total energy, carbohydrates, fats, proteins, key vitamins/minerals (folate, iron, B<sub>12</sub>, zinc, vitamin D, calcium), essential fatty acids
- High-risk pregnancy factors
- Maternal health conditions
  - Unsafe practices during pregnancy



# Review concepts from Chapter 15

- Lactation
  - Hormones
  - Energy nutrients needed
  - Maternal health
  - Benefits for mothers and babies





## Review concepts from Chapter 16

- First 6 months of life:
  - Growth trends
  - Nutrient needs
  - Breast milk: nutrient content, protective factors
    - Colostrum
    - Formula
- 6 months – 1 year:
  - Complementary foods
  - Food allergies
  - Positive food relationships (toddlers)



## Review concepts from Chapter 16

- Nutrient recommendations and growth during childhood
  - Malnutrition in children
  - Obesity in children
  - Meals at school
- Nutrient recommendations and growth during adolescence
- Development of “adult diseases” in children



## Review concepts from Chapter 17

- Body composition changes associated with aging
- “Inflammaging”
- Factors associated with inadequate dietary intake:
  - GI changes
  - Tooth changes
  - Psychological and social challenges
- Nutrient recommendations, common deficiencies, diet-related health issues
  - Vision, arthritis, dementia, Alzheimer's



# Review concepts from Chapter 19

- Foodborne illnesses:
  - Role of food system
  - Safe practices in the kitchen
  - Safe practices for meats and seafood
  - Safe practices while traveling
- Environmental contaminants:
  - Bioaccumulation
  - Pesticide residue
  - Organics (pros and cons)



# Review concepts from Chapter 19

- Food additives
  - Intentional vs indirect
  - Purposes of additives
- Water
  - Concerns about contamination
  - Bottled water
- GMO foods
  - Pros and cons



## Review concepts from Chapter 20

- Hunger in the U.S.
  - Poverty – obesity paradox
  - Federal food assistance programs
- Global hunger
  - Nutrient deficiencies
  - Malnutrition
- Agriculture systems
  - Problems with conventional production: crops, livestock, fishing
  - Sustainable agriculture alternatives
  - Consumer choice and impact on food system