Announcements Nutrition Analysis Lab this Thursday! Please record diet on p 3-7 LM & begin analysis using https://www.supertracker.usda.gov/ Bring flash drive? Q?

Introduction to Genetics LS 2012 ch 2 p 20-1 + Appendix C
A. How does DNA differ from RNA? pp A-20 thru A-22
C. How & where are proteins made? fig C-7, C-9
D. Class skit: Making proteins @ ribosomes!

Nutrition Primer Sizer & Whitney (S&W) Sci Lib
A. Essential Nutrients: H₂O, ¹ Carbohydrates, ² Fats, ³ Proteins, Vitamins, Minerals; Macro- vs Micro-?
B. Dietary Guidelines: USDA, AICR, Eat Like the Rainbow!
D. Beware of Nutrition Quackery S. Kleiner & Monaco 1990!

Nutrition in the News Gain weight by drinking calories?

Introduction to Digestion Steps + hydrolysis
DNA vs RNA?

1. Double-stranded
2. Deoxyribose (without oxygen)
3. A, T, C, G
4. Self-replicative (can copy itself)
5. Nucleus (+mitochondria)

1. Single-stranded
2. Ribose (with oxygen)
3. A, U, C, G
4. Needs DNA as template
5. Cytoplasm (but Nucleus origin)
6. mRNA, rRNA, tRNA
**Triplets of bases code for amino acids, the building blocks of proteins**

<table>
<thead>
<tr>
<th>DNA code word</th>
<th>mRNA codon</th>
<th>tRNA anti-codon</th>
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<tr>
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<td>AUA</td>
<td>UAU</td>
</tr>
<tr>
<td>ACG</td>
<td>UGC</td>
<td>ACG</td>
</tr>
<tr>
<td>TTT</td>
<td>AAA</td>
<td>UUU</td>
</tr>
<tr>
<td>TAC</td>
<td>AUG</td>
<td>UAC</td>
</tr>
<tr>
<td>First base of codon</td>
<td>Second base of codon</td>
<td>Third base of codon</td>
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<tr>
<td>---------------------</td>
<td>----------------------</td>
<td>---------------------</td>
</tr>
<tr>
<td>U</td>
<td>U</td>
<td>Phe UU, UUC, UUA, UUG</td>
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<tr>
<td></td>
<td>C</td>
<td>Leu CU, UCU, UCA, UCG</td>
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<tr>
<td></td>
<td>A</td>
<td>Ser UA, UAC, UAA, UAG, Ty</td>
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<td></td>
<td>G</td>
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<tr>
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<td>U</td>
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</tr>
<tr>
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<td>Pro CC, CCC, CCA, CCG</td>
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<td>U</td>
<td>Ile AU, AUC, AUA, AUG, Met AUG, Start</td>
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<td>C</td>
<td>Thr AC, ACC, ACA, ACC</td>
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<tr>
<td></td>
<td>A</td>
<td>Asn AA, AAC, AAA, AAG</td>
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<tr>
<td></td>
<td>G</td>
<td>Ser AG, AGA, AGG, Arg AGG</td>
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<tr>
<td>G</td>
<td>U</td>
<td>Val GU, GUC, GUA, GUG</td>
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<td>Ala GC, GCC, GCA, GCG</td>
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<tr>
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<td>G</td>
<td>Glu GG, GGC, GGA, GGG, Gly GGG</td>
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Translation? Ribosomes Make Proteins

1. Large subunit
2. Small subunit
3. Amino acid
4. tRNA
5. Anticodon
6. mRNA
7. Leader sequence
8. First codon
9. Second codon

Steps 5 through 8 are repeated.

First ribosomal binding site
Second ribosomal binding site

LS 2012 fig C-7
Transfer RNA (tRNA)
A Polyribosome. Which Way is Synthesis?

Ribosome

Protein

mRNA
Class Skit on Translation!

A protein synthesizing factory, where translation takes place!

What’s a ribosome?

You rock, baby!
Questions + Discussion
Macronutrients & Micronutrients
Essential for Life

**Macronutrients**

- H$_2$O/Water
- 1$^0$ Carbohydrates
- 2$^0$ Fats/Triglycerides/Lipids
- 3$^0$ Proteins

**Sample Food Sources**

- Water, other drinks, fruits & vegetables
- Grains, vegetables, fruits, dairy products
- Meats, full-fat dairy products, oils
- Meats, legumes, dairy vegetables

**Micronutrients**

- Vitamins (A, D, E, K; C + B)
- Minerals ($K^+$, $Na^+$, $Ca^{2+}$, $Mg^{2+}$, $Fe^{2+}$, $Zn^{2+}$, ...)

**NB:** Need only minute quantities!

- Vegetables, vegetable oils, fruits, citrus, grains, dairy
- Fruits, vegetables, grains, nuts, dairy, meats, processed foods

**Energy nutrients = yield ATP**
USDA Food Pyramid 1992

Fats, oils, and sweets
Use Sparingly

Milk, yogurt, and cheese group
2-3 Servings

Vegetable group
3-5 Servings

Meat, poultry, fish, dry beans, eggs, and nuts group
2-3 Servings

Fruit group
2-4 Servings

Bread, cereal, rice, and pasta group
6-11 Servings

Key
- Fat (naturally occurring and added)
- Sugars (added)
US Modifications to 1992 Food Pyramid 2005

Regular Physical Activity: Exercise! Exercise!!

- “good” fats!
- saturated & trans fats!
- 3 or more!
- 5 or more!
- 4 or more!
- eg, fish, nuts
- 1/2 whole grain

KEY
- Fat (naturally occurring and added)
- Sugars (added)

Milk, yogurt, and cheese group
2–3 servings

Vegetable group
3–5 servings

Meat, poultry, fish, dry beans, eggs, and nuts group
2–3 servings

Fruit group
2–4 servings

Bread, rice, pasta group
6–11 servings
1. ↑emphasis on ↓kcal + ↑exercise.
2. 9-A-Day! 4 fruit + 5 vegetable servings.
3. ≥ 3 of 6 whole grains → ½ whole grains!
4. 3 servings of dairy, eg 3 c fat-free milk.
5. ↓saturated + trans fats + ↑unsaturated/
   “good” fats, eg Ω-3 fish, walnuts.
6. Drink in moderation if at all.
7. Practice food safety.
2. **Focus on fruits.** Whole fruit preferable to juice, but any fruit counts! Fill ½ your plate with fruits & vegetables!

3. **Make at least ½ of your grains whole grains!**

4. **Go lean with protein.** Keep protein to < ¼ plate! Nuts, beans, peas, seeds, poultry, lean meat, seafood,…

5. **Get your calcium-rich foods.** Buy skim or 1% milk. Go easy on cheese!

MyPlate launched June 2, 2011
Diet & Health Guidelines for Cancer Prevention

1. Choose a diet rich in variety of plant-based foods.
2. Eat plenty of vegetables & fruits.
3. Maintain a healthy weight & be physically active.
4. Drink alcohol only in moderation, if at all.
5. Select foods low in fat & salt.

And always, remember...

Do not smoke or use tobacco in any form.

American Institute for Cancer Research (AICR)
Eating the Rainbow Hawaiian Style!!

Your plate should be the size of a Frisbee, not a manhole cover.

When it comes to colorful foods, Fruit Loops don’t count.

A surprising number of people get 1/5 of their calories from sodas or other liquids.

If you look at the label & need a chemistry degree to read it, put the item back on the shelf!


NB: Each group 500 kcal deficit/day, 16 weeks
Exercise is better than dieting in lowering body fat & preserving muscles!
Dietary Composition & Physical Endurance

- High-fat diet: ~1/3 endurance
- Normal mixed diet: 57 min
- High-carbohydrate diet: 114 min
- Maximum endurance time: 167 min

eg, Atkins!
Negative Effects of Low Carbohydrate

1. ↑ fatigue/exhaustion central & peripheral!
2. ↓ glucose – brain+spinal cord, rbc's thrive upon.
3. ↓ variety which reduces intake of phytochemicals, vitamins, minerals & fiber.
4. ↑ risk of respiratory infections.

+ gall stones, ↓ thermoregulation...
We’re better at storing fat vs carbohydrate!

Dietary Fat → 3 % Kcal → Body Fat
Dietary Carbohydrate → 23 % Kcal
To Help Lower Body Wt & %Fat
EXERCISE!! +Minimize These!!

- FAT 9 Kcal/g
- ETOH 7 Kcal/g
- CARB 4 Kcal/g
- PRO 4 Kcal/g

NB: Minimize not Eliminate!
Moderation not Abstinence!!
I'm not sure I believe you! Why can't I just starve to lose weight?
TOTAL FAST = No Energy Nutrients (No Carbohydrates, Fats or Proteins)

ONLY

1. Water
2. Vitamins
3. Minerals

ML Pollock & JH Wilmore 1990.
60-day Fast???

Lost 60 lb!! Wow!!

Yet

\[
\begin{align*}
26 \text{ lb Water} \\
20 \text{ lb Lean Body Mass} \\
14 \text{ lb Fat}
\end{align*}
\]

\[> \frac{3}{4}\]

Fat < \frac{1}{4} \text{ total wt loss!}
You can lose weight by starving – but it's mostly water & muscle! Also, there can be complications!
Potential Complications of Total Fasting

Nausea, diarrhea, persistent vomiting, postural hypotension, nutritional deficiencies, menstrual irregularities, and...sudden death.

Positive Aspect??

General loss of appetite within first 2 days, maintained throughout fasting period.

ML Pollock & JH Wilmore 1990.
Well-controlled studies of energy-reduced diets conducted in controlled environments showed that the macronutrient composition of the diet did not affect weight loss (1). Nonetheless, theories persisted that specific macronutrients would be superior for weight loss. For example, the traditional paradigm for low-fat, high-carbohydrate diets was based on the lower energy density of carbohydrate compared to fat, and the metabolic efficiency of converting dietary fat to body fat (2). Indeed strict vegetarians sustain lower body weight for years on low-fat diets (3). However, meaningful differences in body weight usually were not achieved in population-based trials of conventional low-fat diets (4). Thus, higher-fat, Mediterranean-style diets were proposed to be better for long-term weight loss because of their variety and satisfaction. Two trials found that Mediterranean diets were superior to low-fat diets for weight loss (5,6). Others claimed that a radically different approach that used low-carbohydrate, high-fat, and high-protein foods could produce weight loss without attention to reducing intake because of the satiety of protein-rich foods. Low-carbohydrate diets succeeded in the first few months with more rapid weight loss than low-fat diets but by one year, none of the trials found that weight loss on low-carbohydrate...
Dr. Sacks’ Conclusions:
We conclude that healthful diets with varying emphases on carbohydrate, fat & protein levels can all achieve clinically meaningful weight loss & maintenance of weight loss over a 2-yr period. The results give people who need to lose weight the flexibility to choose a diet that they can stick with, as long as it’s heart healthy. Such diets can also be tailored for individuals based on their personal & cultural preferences & in this regard may have the best chance for long-term success.
### US Dietary Recommended Intakes (DRI)
Committee Acceptable Macronutrient Distribution Ranges (AMDR)!

<table>
<thead>
<tr>
<th>Energy Nutrient</th>
<th>% Total Calories</th>
</tr>
</thead>
<tbody>
<tr>
<td>Carbohydrate</td>
<td>45-65%</td>
</tr>
<tr>
<td>Fat</td>
<td>20-35%</td>
</tr>
<tr>
<td>Protein</td>
<td>10-35%</td>
</tr>
</tbody>
</table>
Emphasize ABCs + Variety & Moderation!
All of these factors help to build a nutritious diet.
Kleiner's & Monaco's Top 10 Hit List for Nutrition Quackery

1. Treatment based on unproven theory calling for non-toxic, painless therapy.

2. Author's/purveyor's credentials aren't recognized in scientific community.

3. No reports in scientific, peer-reviewed literature but rather mass media used for marketing.

4. Purveyors claim medical establishment is against them & play on public's paranoia about phantom greed of medical establishment.

5. Treatments, potions, drugs manufactured according to secret formula.

6. Excessive claims promising miraculous cures, disease prevention or life extension.

7. Emotional images rather than facts used to support claims.

8. Treatments require special nutritional support including health food products, vitamins and/or minerals.

9. Clients are cautioned about discussing program to avoid negative.

10. Programs based on drugs or treatments not labeled for such use.
AHA + DASH + MAYO CLINIC

PEER-REVIEWED = TEXTS → RESEARCH

NOT PEER-REVIEWED = TRADE BOOKS

LOWER CARBOHYDRATE
ELIMINATE CALORIES or FOOD GROUPS
ENCOURAGE FASTING

LOWER FAT
ADEQUACY
BALANCE
CONSISTENCY & MODERATION
5 times per wk? $\equiv 106,600$ calories/yr $\equiv \pm 30.5$ lb fat/yr

Better choices!

Starbucks Cinnamon Dolce Latte, whipped cream (Venti (20 oz.)) $\equiv 410$ calories

Jogging $\equiv 50$ min.

Better choices!
Digestion Steps

1. Ingestion
2. Mechanical Digestion
3. Chemical Digestion
4. Peristalsis
5. Absorption
6. Storage
7. Defecation

Hi gang!!
You need me for digestion!!

H₂O + Enzyme
FIGURE 15-1 An example of hydrolysis. In this example, the disaccharide maltose (the intermediate breakdown product of polysaccharides) is broken down into two glucose molecules by the addition of $H_2O$ at the bond site.
Polymer to Monomer (Many to One)

Carbohydrate

Glucose

Protein + Fat

Amino Acids

Fatty Acids + Glycerol