I. **Announcements**  Nutrition Analyses this Thursday! Please record diet on p 3-7 LM & begin analysis using [https://www.supertracker.usda.gov/](https://www.supertracker.usda.gov/)  Bring flash drive? Q?

II. **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!

III. **Nutrition Primer**  Sizer & Whitney (S&W) Sci Lib  
A. Essential Nutrients: H\textsubscript{2}O, 1\textsuperscript{0} Carbohydrates, 2\textsuperscript{0} Fats, 3\textsuperscript{0} Proteins, Vitamins, Minerals; Macro- vs Micro-?  
B. **Blue Zones**? US AMDR? Adjusted Macronutrient Dist…  
C. Dietary Guidelines: USDA, AICR, Eat Like the *Rainbow*!  
D. Diet or exercise? Diet composition & endurance?  
  Zuti & Golding 1976! Fasting?  
E. **Beware of Nutrition Quackery** S. Kleiner & Monaco 1990!

IV. **Nutrition in the News**  Gain weight by drinking calories?

V. **Introduction to Digestion**  Steps + hydrolysis
What are DNA’s major functions?
Heredity + Day-to-Day Cell Function
What does DNA look like? Double-helix!!
Gene = Stretch of DNA that codes for a protein

cf: LS fig C-3
What does DNA do, day-to-day?

DNA → Transcription → RNA → Translation → Protein

Replication → Nucleus → Cytoplasm → @ ribosomes

cf: LS fig C-6
## DNA vs RNA?

<table>
<thead>
<tr>
<th>DNA</th>
<th>RNA</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Double-stranded</td>
<td>1. Single-stranded</td>
</tr>
<tr>
<td>2. Deoxyribose (without oxygen)</td>
<td>2. Ribose (with oxygen)</td>
</tr>
<tr>
<td>4. Self-replicative (can copy itself)</td>
<td>4. Needs DNA as template</td>
</tr>
<tr>
<td>5. Nucleus (+mitochondria)</td>
<td>5. 1° Cytoplasm (but Nucleus origin)</td>
</tr>
<tr>
<td></td>
<td>6. mRNA, rRNA, tRNA</td>
</tr>
</tbody>
</table>
**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>
</tr>
</thead>
<tbody>
<tr>
<td>TAT</td>
<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>
</tbody>
</table>
Translation? Ribosomes Make Proteins
Transfer RNA (tRNA)
A Polyribosome. Which Way is Synthesis?
Class Skit on Translation!

What’s a ribosome?

A protein synthesizing factory, where translation takes place!

You rock, baby!
Questions + Discussion
**Macronutrients & Micronutrients**

**Macronutrients**

- **H₂O/Water**
- **¹⁰ Carbohydrates**
- **²⁰ Fats/Triglycerides/Lipids**
- **³⁰ 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⁺, Ca²⁺, Mg²⁺, Fe²⁺, Zn²⁺,...)

**NB: Need only minute quantities!**

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

**Energy nutrients = yield ATP**
The World’s Longest-Lived People!

Blue Zones!

Lomo Linda, CALIFORNIA
Sardinia, ITALY
Okinawa, JAPAN
Ikaria, GREECE
Nicoya, COSTA RICA

M Poulain & Coworkers. Experimental Gerontology, Sep 2004
1. Eat a little bit better!
2. Move a little bit more!
3. Socialize more!
4. Strong sense of purpose!

Loma Linda, United States
Sardinia, Italy
Okinawa, Japan

https://en.wikipedia.org/wiki/Blue_Zone
https://bluezones.com/
70% Sweet Potatoes
12% Rice
7% Grains & Wheat
6% Soy & legumes
4% Additional vegetables
3% Fruit
2% Oils
1% Nuts (Protein)
1% Other potatoes
1% Seaweed
1% Sugars
1% Fish
1% Dairy
1% Eggs
1% Pork-Meat
1% Flavorings & Alcohol

85% Carbohydrates
9% Protein
6% Fat
85-10-5
1785 Calories

96% Vegan Diet
98% Vegetarian
99% PescaVeg
<4% Animal Prod
<1% Fish
<1% Meat-Pork

Note: These are the Actual Food Measurements of the Centenarians, not the diet of All island Okinawans or the ones who died, but the ones who lived.
## 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>
Pondering Paleo?

Evolutionary Biologist
Behavioral Ecologist
U Minnesota

http://www.nutritionaction.com/daily/how-to-diet/pondering-paleo/
2. **Focus on fruits.** Whole fruit preferable to juice, but any fruit counts! Fill ½ your plate with fruits & vegetables!

1. **Vary your veggies.** Fill ½ your plate with fruits & vegetables!

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

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

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

*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

eg, Atkins! ~ 1/3 endurance!

Maximum endurance time:
- High-fat diet: 57 min
- Normal mixed diet: 114 min
- High-carbohydrate diet: 167 min
Negative Effects of Low Carbohydrate

1. ↑ fatigue/exhaustion
central & peripheral!
2. ↓ glucose – brain+spinal
cord, rbcs 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!
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*}
&\begin{cases}
26 \text{ lb Water} \\
20 \text{ lb Lean Body Mass} \\
14 \text{ lb Fat}
\end{cases}

\Rightarrow \frac{3}{4}
\end{align*}
\]

Fat < \frac{1}{4} 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.
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.
Which Diets are Best?

Not Plant-based
Lower Carbohydrate

Plant-based
Lower Fat

Not Peer-Reviewed = Trade Book → Opinion

Peer-Reviewed = Text Books → Research
5 times per wk? $\equiv 106,600$ calories/yr $\equiv \pm 30.5$ lb fat/yr

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

Hydrolysis of Energy Nutrients
Maltose + Water → Glucose + Glucose

Disaccharide

Peptide (portion of protein molecule) + Water → Amino acid + Amino acid

Fat + Water → Fatty acids + Glycerol

Monosaccharides
**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 $\text{H}_2\text{O}$ at the bond site.
Polymer to Monomer
(Many to One)

Carbohydrate

Protein + Fat

Fat

Protein

Glycerol

Fatty Acids

Glucose

Amino Acids

…Central-linking theme!!