BI 121 Lecture 5

I. Announcements  Data + Flashdrive for Thursday’s lab! Q?
Thanks for recording dietary data on LM p 3-7 & finishing

II. Nutritional Physiology in the News  Pondering Paleo Nutrition
Action Health Letter, Marlene Zuk, U Minn. Animal sources,
inflammation & disease? Drink Your Calories? PEBB Shake the
salt habit! UC Berkeley Newletter. Successful Dieting?

III. Nutrition Primer  DC Module 2, Sizer & Whitney (S&W) Sci Lib
A. Dietary Guidelines: USDA, AICR, Eat Like the Rainbow!
B. Best path to weight loss? Diet or exercise or both?
   Dietary composition & endurance? Fasting?
   Zuti & Golding 1976; Sacks AHA NPAM 2009; AMDR?
C. Nutrition Quackery, Balanced Approach Kleiner, Monaco+

IV. Digestion  LS 2012 ch 15, pp 437-9, DC Module 3 pp 17-23
A. Steps of digestion Dr. Evonuk + LS pp 437- 9; DC p 23
B. Hydrolysis + monomer to polymer: central linking themes!
   LS p 438, Fox 2009 +
C. What’s missing? LS fig 15-1 p 438
D. GI-Donut analogy + Control mechanisms. Dr. Brilla @ WWU
E. Gut secretions LS p 438, 440-1
F. Organ-by-organ review LS tab 15-1 pp 440-1 + DC fig 3-1
Lab 3: Nutritional Analyses via 2 Programs

https://www.supertracker.usda.gov/

In Lab Thursday!
Sample Exam I Questions

Sample 1. What is *human physiology*? (+2) How does it differ from *human anatomy*? (+2)

Sample 2. Give 2 examples of when *positive feedback* may occur normally in the human body. (+4)

Sample 3. *Cells* are progressively organized into
a. organs, systems, tissues, then the whole body
b. tissues, organs, systems, then the whole body
c. systems, tissues, organs, then the whole body
d. None of the above are correct.
Pondering Paleo?

Evolutionary Biologist
Behavioral Ecologist
U Minnesota

http://www.nutritionaction.com/daily/how-to-diet/pondering-paleo/
Gut Bacteria Involved in Inflammation & Atherosclerosis?

Meat & Eggs $\rightarrow$ L-Carnitine & Choline $\rightarrow$ Trimethyl Amine (TMA) $\rightarrow$ TMAO $\rightarrow$ Inflammation & Atherosclerosis

Dietary Choline & L-Carnitine

The pathway linking diet, gut microbes and TMAO to a growing collection of disease states

Gut Flora
Hepatic FMOs
TMAO = Trimethyl Amine

Choline

Heart Failure
Kidney Disease
Atherosclerosis

With the right food choices, physical activity, and not smoking, we could prevent about ~90% of diabetes, 80% of heart disease & 70% of stroke!
Can Lifestyle Modifications Alter Blood Pressure, Cardiovascular & Kidney Disease Risk?

↓ 5-20 mm Hg
↓ 4-9 mm Hg
↓ 2-8 mm Hg

Do the DASH!

↓ 8-14 mm Hg
↓ 2-4 mm Hg
More Reasons to Shake the Salt Habit

1. Blood vessel vasodilation w/in 30 min by ingesting 1500 mg Na+!
2. Ca²⁺ excretion, ↑ bone loss, risk of osteoporosis & fractures.
4. GI cancer risk, inflammation?

Stop me!

UCB Wellness Letter Jun 2011 p 5
5 times per wk? ≡ 106,600 calories/yr ≡ ± 30.5 lb fat/yr

Starbucks Cinnamon Dolce Latte, whipped cream (Venti (20 oz.)) | 410 calories

Better choices!
MyPlate launched June 2, 2011

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

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!
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!

High-fat diet

Normal mixed diet

High-carbohydrate diet

~ 1/3 endurance!

Maximum endurance time:

57 min

114 min

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!

Dietary Fat

3% Kcal

Body Fat

23% Kcal

Dietary 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
26 lb Water
20 lb Lean Body Mass
14 lb Fat

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.
Successful Dieting – National Weight Control Registry

- 5000 people, ≥ 30 lb weight loss, ≥ 5 yr
- High-carbohydrate (55-60%), low-fat (24%) diet with the rest (~16-21%) from protein
- Wholesome vs. high-sugar carbohydrates including fruits, vegetables, high-fiber foods
- Conscious of calories knowing that total calories count, no matter what diet type
- Eight of 10 ate breakfast daily which may help better manage calories during the day
- Self-monitor, weigh themselves ≥ 1x/wk & many still keep food dairies
- Much planned physical activity, 60-90 min/d, 10,000 steps walking + looked for other ways to be active

http://www.nwcr.ws/Research/published%20research.htm
UC Berkeley Wellness Engagement Calendar, September 2013
Which Diets are Best?

Not Plant-based Lower Carbohydrate

Not Peer-Reviewed = Trade Book
→ Opinion

Plant-based Lower Fat

Peer-Reviewed = Text Books
→ Research
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.
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!!

\[ \text{H}_2\text{O} + \text{Enzyme} \]
What's missing?

**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)

Fat

Protein

Carbohydrate

Glucose

Amino Acids

Fatty Acids

Glycerol

Central-linking theme!!
GI-DONUT ANALOGY

GI LUMEN

BODY
Common Control Mechanisms

1. Local (autoregulation)
2. Nervous (rapidly-acting)
3. Hormonal (slower-acting/reinforcing)
Longitudinal $\rightarrow$ Shortens L

Circular $\rightarrow$ $\downarrow$ d or Width

Body wall
Serosa
Submucosa
Outer longitudinal muscle
Inner circular muscle
Mucosa
Lumen
Duct of large accessory digestive gland (i.e., liver or pancreas) emptying into digestive-tract lumen
Myenteric plexus
Submucous plexus
Muscularis externa
Muscularis Externa

Glands

Lumen

Epithelium

Submucosa

Lamina Propria

Longitudinal Muscle

Circular Muscle

Meissner’s sensory & secretory plexus!

Myenteric motor plexus!

Serosa

H Howard 1990
cf: G&H fig 62-2
**Gut Secretions**

<table>
<thead>
<tr>
<th>Secretion</th>
<th>Release Site</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Mucus</td>
<td>into GI Lumen</td>
</tr>
<tr>
<td>2. Enzymes</td>
<td>into GI Lumen</td>
</tr>
<tr>
<td>3. H₂O, acids, bases+</td>
<td>into GI Lumen</td>
</tr>
<tr>
<td>4. Hormones</td>
<td>into Blood</td>
</tr>
</tbody>
</table>
1. **Mouth**

*Ingestion* entry way
salivary gland secretion
mucus + enzymes
enzymatic digestion: carbohydrate
mastication = chewing
deglutition = swallowing

2. **Esophagus**

*Rapid transit*
peristalsis
secretion mucus

3. **Stomach**

*Mixing*
peristalsis
secretion mucus + HCl
+ enzymes
enzymatic digestion:
protein + butter fat!

4. **Liver-Gall Bladder**

*Emulsification* =
detergent action of bile
+ secretion

5. **Pancreas**

*Secretion* mucus + NaHCO$_3$ + enzymes
enzymatic digestion:
carbohydrate, fat, protein

6. **Small Intestine**

*Absorption*
Secretion mucus
+ enzymes
enzymatic digestion:
carbohydrate, fat, protein

Peristalsis

7. **Large Intestine**

*Dehydration*
secretion + absorption
storage + peristalsis