BI 121 Lecture 6 + Q + ½ Midterm Review

I. **Announcements** Next session Q? ~½ review, then Midterm. Fun Lab 3 Nutrition today! Sample Suisse Calculation? Q?

II. **Nutrition in the News** Be a whiz at healthy grilling! [American Institute for Cancer Research](https://www.aicr.org), Grilling Quiz!

III. **Digestion Connections** LS ch 15, DC Module pp 17-23
   A. Histology of the gut LS fig 15-2, 15-3 p 442-3
   B. Stomach protein digestion + zymogens? LS fig 15-7, 15-9
   C. Accessory organs: Pancreas & Liver + Recycling!
      LS pp 457-63
      [http://www.cdc.gov/ulcer](http://www.cdc.gov/ulcer) Beyond the Basics LS p 456
   E. Summary of chemical digestion LS tab 15-5 p 466
   F. Large intestine? LS fig 15-24 pp 472-4

IV. **Midterm Review** Discussion + Q?
Stay **focused now!**

*Later, have fun & be safe!!*
% Calories? Know:

Carbohydrate? 4 kcal/g
Fat? 9 kcal/g
Protein? 4 kcal/g
How Do I Calculate the % of Total Calories from Carbohydrate, Fat & Protein?

Carbohydrate  
46 g x 4 kcal/g = 184 kcal  
% Carbohydrate = 184/567 = 0.326 ≡ ~33%

Fat  
39 g x 9 kcal/g = 351 kcal  
% Fat = 351/567 = 0.619 ≡ ~62%

Protein  
8 g x 4 kcal/g = 32 kcal  
% Protein = 32/567 = 0.056 ≡ ~6%

∑ = 567 kcal
Be a Whiz at Healthy Grilling

Summertime is grilling time for Americans. Unless you take some simple precautions, however, grilling food can raise the risk of cancer. Take this multiple-choice quiz to see if you know the dos and don’ts of grilling for great taste and good health. Questions may have more than one correct answer.

1. Grilling can raise cancer risk because:
   A. The grill is usually dirty.
   B. Flies and pollution from the air can land on the food.
   C. Red meat, poultry or seafood can form carcinogenic compounds called heterocyclic amines (HCAs) when exposed to high heat. HCAs can damage the DNA of our genes, beginning the process of cancer development.
   D. Fat from red meat, poultry and seafood can drip, creating a cancer-causing substance called polycyclic aromatic hydrocarbons (PAHs). Smoke and flare-ups deposit the PAHs back on the meat.

2. What are the best choices for grilling?
   A. Vegetables and fruits because they don’t form HCAs.
   B. Vegetables because natural phytochemicals in them stimulate enzymes that can convert HCAs to an inactive form that is easily eliminated from the body.
   C. Lean meats, like skinless chicken and fish, because they drip less fat.
   D. Small portions of red meat, like kebabs, because they cook fast.

3. A marinade can decrease carcinogens that form during grilling up to 96 percent because:
   A. It acts as a barrier, keeping flames from directly touching the meat.
   B. Typical marinade ingredients, like vinegar, citrus juices and olive oil, have special protective powers.
   C. Scientists aren’t sure why.

4. If you decide to grill meat, which simple cooking adjustment(s) will reduce the formation of carcinogens?
   A. Covering the grill with punctured aluminum foil.
   B. Turning the gas down or waiting for charcoal to become low-burning embers.
   C. Raising the grilling surface.

D. Placing meats to the side of the heat source.

5. Flipping meat every minute can also reduce the formation of carcinogens for the following reason(s):
   A. Turning the meat often accelerates the cooking process, so there is less exposure to heat.
   B. Flipping propels HCAs off the meat into the air.
   C. Charring is less likely.

6. Safer methods of cooking meat than grilling include:
   A. Microwaving  
   C. Stewing
   B. Roasting  
   D. High-heat pan frying

7. If you decide to grill red meat, to limit cancer risk you should eat no more in a day than what amount?
   A. 22 ounces  
   C. 10 ounces
   B. 1 pound  
   D. 3 ounces

FREEFACTS► For more information about safe grilling, order a free copy of AICR’s brochure, “The Facts About Grilling.” Check box 4 on the Free Information Request card, or contact AICR national headquarters.
American Institute for Cancer Research (AICR) Healthy Grilling Quiz Summary

1. **Marinade, marinade, marinade!** By doing so, you can decrease carcinogens formed during grilling by $\leq 96\%$!

2. **Cover the grill with aluminum foil**, turn gas down or wait for low-burning embers, cook to the side.

3. **Best choices for grilling include vegetables and fruits** (no HCAs + enzymes to inactivate HCAs!), and lean meats (e.g., fish & skinless chicken ↓ PAHs).

4. **Flip meat every minute** to reduce charring & remove charred portions prior to eating.

5. **To limit cancer risk, eat no more than 3 oz grilled red meat.** Cook small portions/kebabs.

AICR Newsletter, Summer 2006
Duct of large accessory digestive gland (i.e., liver or pancreas) emptying into digestive-tract lumen
Muscularis Externa

Glands

Muscularis Externa

Meissner’s sensory & secretory plexus!

Myenteric motor plexus!

Serosa

cf: G&H fig 62-2

Epithelium

Submucosa

Lumen

Lamina Propria

Longitudinal Muscle

Circular Muscle

H Howard 1990

LOCAL
Where does enzymatic digestion of protein begin?
Zymogen = an inactive precursor
Why is the pancreas so unique?
Endocrine + Exocrine functions; Makes enzymes for digesting all 3 energy nutrients!
Stomach (partly removed to show underlying pancreas)

Liver

Common bile duct

Gallbladder

Pancreatic duct

Duodenum

Pancreas
Liver: Amazing Recycling of Bile Salts!

1. Secreted bile salts consist of 95% old, recycled bile salts and 5% newly synthesized bile salts.

2. 95% of bile salts are reabsorbed by terminal ileum.

3. Reabsorbed bile salts are recycled by enterohepatic circulation.

4. 5% of bile salts are lost in feces.
What is the major function of the small intestine? Absorption!!
http://www.cdc.gov/ulcer/
Ulcer Facts

• Most ulcers are caused by an infection, not spicy food, acid or stress.
• The most common ulcer symptom is burning pain in the stomach.
• Your doctor can test you for *H. pylori* infection.
• Antibiotics are the new cure for ulcers.
• Eliminating *H. pylori* infections with antibiotics means that your ulcer can be cured for good.
Clipping a Duodenal Ulcer

Peering through the pylorus into the duodenum, we see some blood and a vessel sticking out of the wall, just at the front edge of a small but deep ulcer.

In the second photograph, a disposable metal clip is applied to the ulcer. The patient remained well and left hospital three days later.
### Table 15-5 Digestive Processes for the Three Major Categories of Nutrients

<table>
<thead>
<tr>
<th>Nutrients</th>
<th>Enzymes for Digesting the Nutrients</th>
<th>Source of Enzymes</th>
<th>Site of Action of Enzymes</th>
<th>Action of Enzymes</th>
<th>Absorbable Units of the Nutrients</th>
</tr>
</thead>
<tbody>
<tr>
<td>Carbohydrates</td>
<td>Amylase</td>
<td>Salivary glands</td>
<td>Mouth and (mostly) body of stomach</td>
<td>Hydrolyzes polysaccharides to disaccharides (maltose)</td>
<td>Monosaccharides, especially glucose</td>
</tr>
<tr>
<td></td>
<td>Disaccharidases (maltase, sucrase, lactase)</td>
<td>Exocrine pancreas</td>
<td>Small-intestine lumen</td>
<td>Hydrolyze disaccharides to monosaccharides</td>
<td></td>
</tr>
<tr>
<td>Proteins</td>
<td>Pepsin</td>
<td>Stomach chief cells</td>
<td>Stomach antrum</td>
<td>Hydrolyzes protein to peptide fragments</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Trypsin, chymotrypsin, carboxypeptidase</td>
<td>Exocrine pancreas</td>
<td>Small-intestine lumen</td>
<td>Attack different peptide fragments</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Aminopeptidases</td>
<td>Small-intestine epithelial cells</td>
<td>Small-intestine brush border</td>
<td>Hydrolyze peptide fragments to amino acids</td>
<td>Amino acids</td>
</tr>
<tr>
<td>Fats</td>
<td>Lipase</td>
<td>Exocrine pancreas</td>
<td>Small-intestine lumen</td>
<td>Hydrolyzes triglycerides to fatty acids and monoglycerides</td>
<td>Fatty acids and monoglycerides</td>
</tr>
<tr>
<td></td>
<td>Bile salts (not an enzyme)</td>
<td>Liver</td>
<td>Small-intestine lumen</td>
<td>Emulsify large fat globules for attack by pancreatic lipase</td>
<td></td>
</tr>
</tbody>
</table>
Large Intestine Structure & Function
Ascending portion of large intestine

Ileum of small intestine

Cecum

Appendix
Lab 3: Nutritional Analyses via 2 Programs

ChooseMyPlate.gov

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