I. **Announcements** Outline comment status?
Nutrition reports w/answers to questions submitted by e-mail by Wednesday.  lombardi@uoregon.edu
Please use requested format. Q?

II. **National Heart, Lung & Blood Institute** Go, Slow, Whoa!
Identifying Go, Slow, Whoa Foods! Partner contest!

III. **Carbohydrate Digestion & Glucose Regulation** ch 4 pp131-7

IV. **Glycemic Index & Diabetes Mellitus** pp 137-50

V. **Are Added Sugars Bad for You?** pp 151-5

VI. **Quiz Bowl** Ch 4 Group Competition

VII. **The Lipids: Fats, Oils, Phospholipids & Sterols** Lipoid? S&W ch 5 pp 156-64 Importance of Fats + a Close Look!
Carbohydrate digestion begins in the mouth... but enzyme is turned off by stomach acidity

Fibers travel unchanged to large intestine

...enzyme from pancreas resumes enzymatic digestion

Small intestine enzymes split dimers into monomers

Monomers enter capillaries & are delivered to liver

Liver converts galactose & fructose to glucose

Key:

- Galactose
- Lactose
- Sucrose
- Maltose
- Fiber starch
- Glucose
Glucose breakdown yields energy + CO$_2$
If you're gonna eat the food, you'd better play the game!
**Glycemic Index?**

<table>
<thead>
<tr>
<th>Food Item</th>
<th>Glycemic Index</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rice milk</td>
<td>87</td>
</tr>
<tr>
<td>Baked potato, boiled potato</td>
<td>87</td>
</tr>
<tr>
<td>Sports drinks, jelly beans</td>
<td>87</td>
</tr>
<tr>
<td>Pumpkin, popcorn, bagel</td>
<td>75</td>
</tr>
<tr>
<td>Raisins, brown rice</td>
<td>62</td>
</tr>
<tr>
<td>Honey</td>
<td>50</td>
</tr>
<tr>
<td>Ice cream</td>
<td>50</td>
</tr>
<tr>
<td>Corn, pound cake</td>
<td>50</td>
</tr>
<tr>
<td>Rye bread, orange juice</td>
<td>50</td>
</tr>
<tr>
<td>Grapes, corn tortillas</td>
<td>50</td>
</tr>
<tr>
<td>Bran cereals, black-eyed peas, peaches, oranges</td>
<td>37</td>
</tr>
<tr>
<td>Tomato juice, navy beans, apples, pears</td>
<td>37</td>
</tr>
<tr>
<td>Soy milk</td>
<td>37</td>
</tr>
<tr>
<td>Chickpeas (garbanzo beans)</td>
<td>25</td>
</tr>
<tr>
<td>Barley</td>
<td>25</td>
</tr>
<tr>
<td>Peanuts</td>
<td>12</td>
</tr>
<tr>
<td>S&amp;W 2104 fig 4-14 p 138</td>
<td></td>
</tr>
</tbody>
</table>

**Fructose**

**Glucose**

<table>
<thead>
<tr>
<th>Food Item</th>
<th>Glycemic Index</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mashed potato, instant; rice crackers</td>
<td>100</td>
</tr>
<tr>
<td>Cornflakes</td>
<td>95</td>
</tr>
<tr>
<td>Oatmeal, instant</td>
<td>95</td>
</tr>
<tr>
<td>Watermelon, doughnut</td>
<td>95</td>
</tr>
<tr>
<td>White bread, wheat bread, white rice</td>
<td>95</td>
</tr>
<tr>
<td>Couscous, sucrose (table sugar)</td>
<td>95</td>
</tr>
<tr>
<td>Cola, pineapple</td>
<td>95</td>
</tr>
<tr>
<td>Oatmeal, cooked</td>
<td>95</td>
</tr>
<tr>
<td>Bananas, mangoes</td>
<td>95</td>
</tr>
<tr>
<td>Green peas, baked beans, pasta</td>
<td>95</td>
</tr>
<tr>
<td>Chocolate pudding, chocolate candy</td>
<td>95</td>
</tr>
<tr>
<td>Apple juice, dates, carrots</td>
<td>95</td>
</tr>
<tr>
<td>Yogurt, milk</td>
<td>95</td>
</tr>
<tr>
<td>Butter beans, lentils</td>
<td>95</td>
</tr>
<tr>
<td>Kidney beans</td>
<td>95</td>
</tr>
<tr>
<td>Cashews, cherries</td>
<td>95</td>
</tr>
<tr>
<td>Soybeans</td>
<td>95</td>
</tr>
<tr>
<td>Carbs (fructose)</td>
<td>95</td>
</tr>
<tr>
<td>Sugar</td>
<td>95</td>
</tr>
<tr>
<td>Fructose</td>
<td>95</td>
</tr>
<tr>
<td>Fructose</td>
<td>95</td>
</tr>
<tr>
<td>Fructose</td>
<td>95</td>
</tr>
<tr>
<td>Fructose</td>
<td>95</td>
</tr>
</tbody>
</table>
Endocrine Pancreas: Insulin (I) & Glucagon (G) See-Saw Hormones in Regulating Blood Glucose

Hormones (insulin, glucagon)

Duodenum

Bile duct from liver

Stomach

Duct cells secrete aqueous NaHCO₃ solution

Acinar cells secrete digestive enzymes

Exocrine portion of pancreas (Acinar and duct cells)

Endocrine portion of pancreas (Islets of Langerhans)

Blood

The glandular portions of the pancreas are grossly exaggerated.
**Times of Plenty!!**

**NB:** Diabetics have problems either here or here.

*Cellular uptake and utilization of glucose*

Fox 1987
Times of Need!

Blood

Glucose

Islets

A cells

Glucagon

B cells

Insulin

Cellular uptake of glucose

Glycogenolysis

Glucose

Mobilize!!
1994 Diabetes Prevalence in the US by State

2010 Diabetes Prevalence in the US by State

Source: Centers for Disease Control, Division of Diabetes Translation, [http://www.cdc.gov/diabetes/statistics](http://www.cdc.gov/diabetes/statistics), S&W 2014 fig 4-15 p139B.
<table>
<thead>
<tr>
<th></th>
<th>Type 1</th>
<th>Type 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Percentage of cases</td>
<td>5–10%</td>
<td>90–95%</td>
</tr>
<tr>
<td>Age of onset</td>
<td>&lt;30 years</td>
<td>&gt;40 years&lt;sup&gt;a&lt;/sup&gt;</td>
</tr>
<tr>
<td>Associated characteristics</td>
<td>Autoimmune diseases, viral infections,</td>
<td>Obesity, aging, inherited factors</td>
</tr>
<tr>
<td></td>
<td>inherited factors</td>
<td></td>
</tr>
<tr>
<td>Primary problems</td>
<td>Destruction of pancreatic beta cells;</td>
<td>Insulin resistance, insulin deficiency</td>
</tr>
<tr>
<td></td>
<td>insulin deficiency</td>
<td>(relative to needs)</td>
</tr>
<tr>
<td>Insulin secretion</td>
<td>Little or none</td>
<td>Varies; may be normal, increased, or</td>
</tr>
<tr>
<td></td>
<td></td>
<td>decreased</td>
</tr>
<tr>
<td>Requires insulin</td>
<td>Always</td>
<td>Sometimes</td>
</tr>
<tr>
<td>Older names</td>
<td>Juvenile-onset diabetes</td>
<td>Adult-onset diabetes</td>
</tr>
<tr>
<td></td>
<td>Insulin-dependent diabetes mellitus (IDDM)</td>
<td>Noninsulin-dependent diabetes mellitus</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(NIDDM)</td>
</tr>
<tr>
<td>Table 4–9</td>
<td></td>
<td></td>
</tr>
<tr>
<td>-------------</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Warning Signs of Diabetes</strong></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

These signs appear reliably in type 1 diabetes and, often, in the later stages of type 2 diabetes.

- Excessive urination and thirst
- Glucose in the urine
- Weight loss with nausea, easy tiring, weakness, or irritability
- Cravings for food, especially for sweets
- Frequent infections of the skin, gums, vagina, or urinary tract
- Vision disturbances; blurred vision
- Pain in the legs, feet, or fingers
- Slow healing of cuts and bruises
- Itching
- Drowsiness
- Abnormally high glucose in the blood
Genetic inheritance
• Excess food energy
• Inadequate physical activity

Obesity
• Reduced glucose use for fuel
• Increased fat stores

• Enlarged fat mass
• Elevated blood lipids
• Inflammation

Type 2 diabetes
• Hormone imbalance

• Insulin resistance

S&W 2014 fig 4-16 p 141
Two talk about living with diabetes

http://login.cengage.com/sso/
Diabetics must constantly juggle diet, exercise & medication to control blood glucose!
Monitoring blood glucose is a critical step in learning to manage diabetes.
Glucose: Sugar in Blood

Normal: 70-99
Pre-Diabetes: 100-125
Diabetes: ≥ 126 mg/dL
Like others, diabetics benefit from whole grains, vegetables, fruits, legumes & non-/low-fat milk products!
Sugar alcohols like xylitol, mannitol & sorbitol can protect teeth against tooth decay.
Exercise is a must based on its insulin-like effect!
Just look for these groups to find the carbohydrates in foods!
Sugar in processed foods?

- ½ cup canned corn = 1 tsp sugar
- 1 Tbs ketchup = 1 tsp sugar
- 1 Tbs creamer = 2 tsp sugar
- 8 oz sweetened yogurt = 8 tsp sugar
- 12 oz cola ≥ 10 tsp sugar
- 2 oz chocolate = 8 tsp sugar
Figure C4–1

Increases in Adult Body Weight over Time

- **Key:**
  - Men
  - Women

- **Years:** 1980, 1990, 2000, 2005
- **Body weight (lb):** 125, 150, 175, 200

S&W 2014 fig C4-1 p 151
Carbohydrates, and mostly added sugars, account for almost all of the increase in energy intakes during this period.
Sugary Desserts: #1 calorie source for those 2 yr & older!

Sugar-sweetened Soft Drinks: #2 for adolescents & young adults!
Knock-out punch # 1 & # 2!!
Figure C4-3
Sources of Added Sugars in the U.S. Diet

- Soda, energy drinks, sports drinks: 35.7%
- Grain-based desserts: 12.9%
- Dairy desserts: 6.5%
- Fruit drinks: 10.5%
- Ready-to-eat cereals: 3.8%
- Sugars and honey: 3.5%
- Tea: 3.5%
- Yeast breads: 2.1%
- All other food categories: 15.4%

Each person in the US ingests ~ \( \frac{3}{4} \) cup or 31 tsp of refined sugars added to foods & beverages each day ~132 lb per year!
**Glucose & Fructose in Common Added Sugars**

- **High-fructose corn syrup**: Alter lipid metabolism & promote fatty deposition in the liver, abdominal obesity & prediabetes!

- **Sucrose**: 50% Fructose, 50% Glucose

- **Corn syrup (regular type)**: 50% Fructose, 50% Glucose

- **Honey**: 50% Fructose, 50% Glucose

---

**NB**: HFCS alters lipid metabolism & promotes fatty deposition in the liver, abdominal obesity & prediabetes!
Quiz Bowl, Chapter 4: Group Competition

1. The dietary monosaccharides (monomers) include:
   a. sucrose, glucose & lactose
   b. fructose, glucose & galactose
   c. galactose, maltose & glucose
   d. glycogen, starch & fiber

2. The polysaccharide that helps form the supporting structures of plants is:
   a. cellulose
   b. maltose
   c. glycogen
   d. sucrose

3. Enzymatic digestion of carbohydrate begins in the:
   a. mouth    b. stomach       c. small intestine    d. large intestine

4. When blood glucose rises, the pancreas secretes ____ & when blood glucose falls, the pancreas secretes ____.
   a. glycogen, insulin
   b. insulin, glucagon
   c. glucagon, glycogen
   d. insulin, fructose
5. When the body uses fat for fuel without the help of carbohydrate, this results in the production of:
   a. ketone bodies      b. glucose      c. starch      d. galactose

6. Foods rich in soluble fiber lower blood cholesterol?  T  F

7. *Type I diabetes* is most often controlled by successful weight loss management.  T  F

8. Around the world, most people are lactose intolerant?  T  F

9. By law, enriched white bread must equal whole grain bread in nutrient content?  T  F

10. The fiber-rich portion of the wheat kernel is the bran layer.  T  F
Muscle tissue

Fat tissue

Blood capillaries

Fat cell

Lipids enter from blood

Lipids exit to blood

Nucleus

Cell membrane

S&W 2014 fig 5-1 p 159
Fat helps cushion joints & protect internal organs!
Carbohydrate-rich lunch

1 low-fat muffin
1 banana
2 oz carrot sticks
8 oz fruit yogurt

calories = 550
weight (g) = 500
Fat-rich lunch
6 butter-style crackers
1 1/2 oz American cheese
2 oz trail mix with candy

calories = 550
weight (g) = 115
Glycerol + 3 fatty acids of differing lengths → A triglyceride formed from 1 glycol + 3 fatty acids

S&W 2014 fig 5-3 p 160
Small amounts of fat offers pleasure & essential nutrients!
The more unsaturated the fat, the more liquid it is at room $^\circ$C. The more saturated the fat, the higher the $^\circ$C at which it melts.
### Key:
- Saturated fatty acids
- Polyunsaturated, omega-6 fatty acids
- Monounsaturated fatty acids
- Polyunsaturated, omega-3 fatty acids

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

<table>
<thead>
<tr>
<th>Fat Type</th>
<th>Saturated</th>
<th>Monounsaturated</th>
<th>Polyunsaturated Omega-6</th>
<th>Polyunsaturated Omega-3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Coconut oil</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Butter</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Beef tallow (beef fat)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Palm oil</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lard (pork fat)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Chicken fat</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th>Fat Type</th>
<th>Saturated</th>
<th>Monounsaturated</th>
<th>Polyunsaturated Omega-6</th>
<th>Polyunsaturated Omega-3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Olive oil</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Canola oil</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Peanut oil</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th>Fat Type</th>
<th>Saturated</th>
<th>Monounsaturated</th>
<th>Polyunsaturated Omega-6</th>
<th>Polyunsaturated Omega-3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Safflower oil</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sunflower oil</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Corn oil</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Soybean oil</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Walnut oil</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cottonseed oil</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th>Fat Type</th>
<th>Saturated</th>
<th>Monounsaturated</th>
<th>Polyunsaturated Omega-6</th>
<th>Polyunsaturated Omega-3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Flaxseed oil</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fish oil</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

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*aThese families of polyunsaturated fatty acids are explained in a later section.

*bSafflower oil over 70% linoleic acid.

*cFish oil average values derived from USDA data for salmon, sardine, and herring oils.
Emphasize good fats from plant sources like avocados!