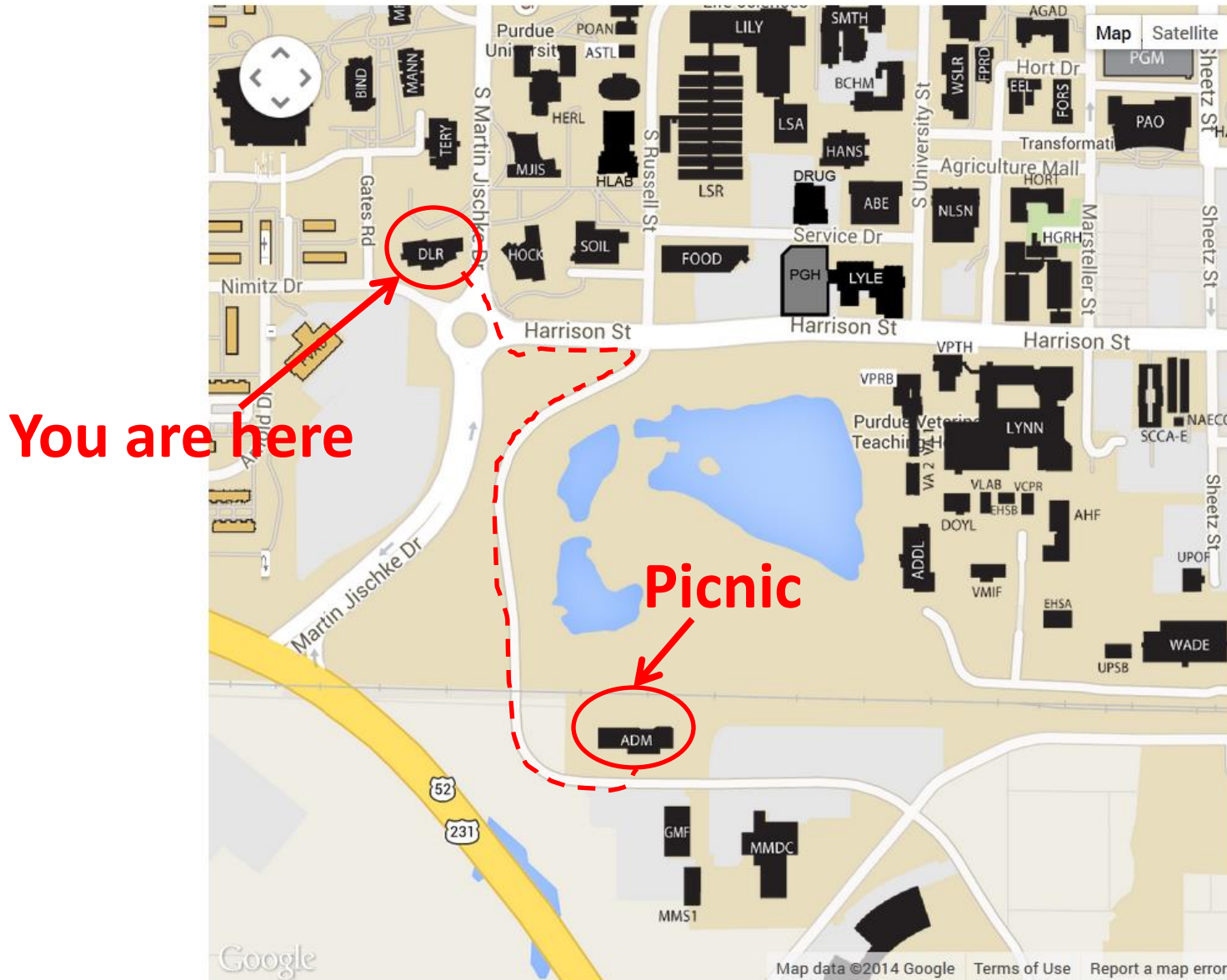# ABE Picnic TUESDAY at 5:30pm

Lab 2 (8/29/16)

Due for Lab 2

- StrengthsFinder 2.0 book (or at least the code for the assessment if you've not already taken it)

Agenda for Lab 2

- Reminder: Product/Process Reviews (First one due September 26)
- Project 1: Label deconstruction – ingredient functionality
- Team Assignments

Due Next Lab (9/12/16)

- Strengths Finder quiz results
- Team Lab Notebook
- Your energy bar wrapper <u>in your notebook!</u>
- List of your ingredients and the function of each <u>in your notebook!</u> Ingredient functions include:
  - Texture
  - Structure
  - Taste
  - Color
  - Macro nutrients (protein, calories, etc.)
  - Micro nutrients (vitamins, minerals, etc.)

New Product or Process Reviews

- Two assignments (first one due 9/26)

- <u>Any</u> new product or process (related to biological engineering)

- Critical analysis needed
  - Separate the advertisement and hype from the reality
  - Do the claims stand up? What is the science/engineering backing up the claim?

Format

- <u>Everyone</u> must complete the review (see Word document on Blackboard)

- Before the due date you will "pitch" your product or process to your teammates during lab prep.

- Your team must decide to put <u>one</u> product or process forward to the whole class (9/26).

Format

- The team member who is selected to present <u>gets 5 bonus points</u> added to their grade.

- During lab each team representative gets:
  - 3 minutes
  - 1 static PowerPoint slide

- Whole class votes for best review
  - <u>Every member</u> of the winning team gets <u>5 more bonus points added to their grade</u>

• Water baths/Incubation stations with temperature controls (30 C - 42 C)
• Shaker incubation becomes continuous liquid growth with temperature & flow controls (flow & dimensions optimized)
•Real time data analysis in a browser
•Contained inactivation protocol (uses contained chemical inactivation)

Amino: Synbio for Everyone

Chicken Noodle Soup…for your Keurig!

- Fast, easy way to prepare a meal.
- Comes with a noodle packet and the K-Cup.
- Convenient enough for even young children to make.

CelluComp: **Curran**

- Derived from waste product of sugar beets.

- 2x stronger than carbon fiber.

- Current uses: Fly fishing rods, additive in paint

- Future Uses: As a thread (similar to carbon fiber), airplane wings, car parts, additive in recycled paper.
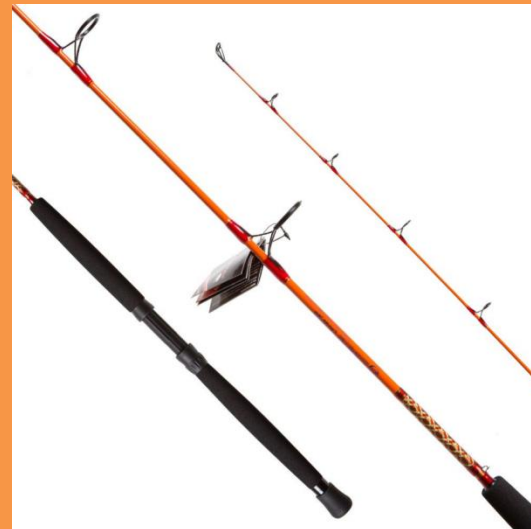
Cocoon-Like Self-Degradable DNA Nanoclew for Anticancer Drug Delivery

- Strand of DNA shaped into a cocoon
- Contains Doxorubicin (DOX) and Dnase coated in a polymer to stop from slicing DNA
- Surface folic acid ligands bind to cancer cell receptors
- Cancer cell envelops cocoon
- Acidity eats away polymer covering Dnase
- Dnase slices DNA and releases DOX killing cell
- Biocompatible
- Preclinical testing
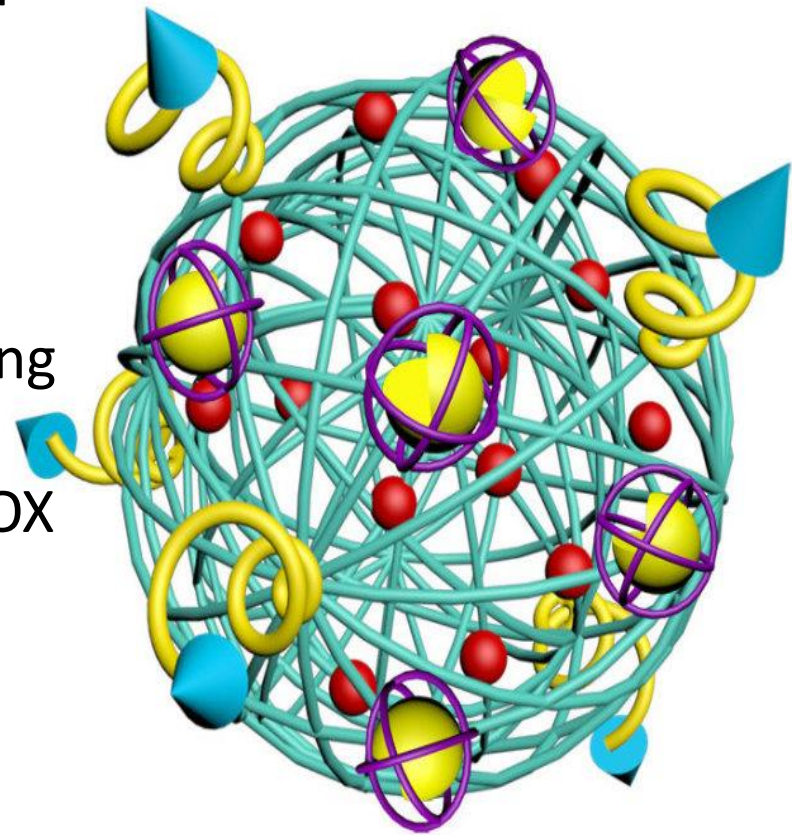
Lab 2- Ingredient Functionality

What is Food?

Function of Food Ingredients

- Nutrition
  - Macro-nutrients: calories, fiber, etc.
  - Micro-nutrients: vitamins, minerals, etc.
- Texture
- Flavor = taste + smell
- Preservation/stability

Each Food Component Serves at least One Function

Water

- Overlooked, but critical component of living systems and food
- Functions of water
  - Solvent
  - Reactant/product of reactions
  - Heat transfer medium
  - Texturizer/Plasticizer
  - Important for shelf stability
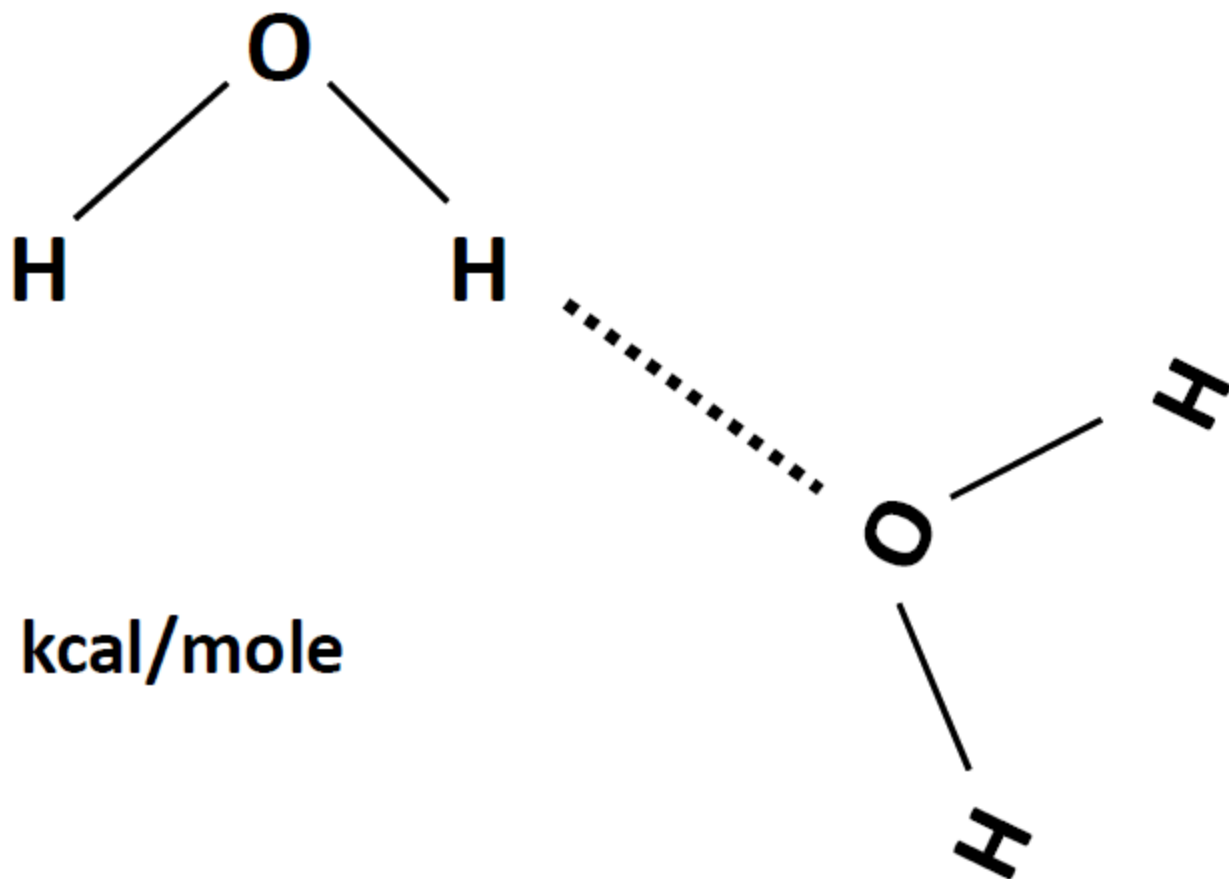
2-10 kcal/mole

Water activity

- Water activity = a_w
- $a_w = p/p_o$
  - where p = water vapor pressure over a food and p_o = water vapor pressure over pure water

- Or $a_w = ERH/100$
  - where ERH = equilibrium relative humidity

Water Activity

- Old concept
  - Water activity was thought of as the ratio of "free" and "bound" water
- New concept
  - It is now regarded as a measure of the energy status of water in the system
  - The closer the a_w of a system is to 1 the nearer the water in that system is to behaving like pure water
- This ratio affects many food properties, especially shelf life and texture

Water Content

7% moisture content

15% moisture content

Which way does the water move and what is the effect?

Water Activity

$a_w = 0.79$

$a_w = 0.61$

Which way does the water move and what is the effect?

Water activity and shelf life

- Most chemical reactions stop at $a_w < 0.8$
- Bacterial growth stops at $a_w < 0.9$
- Molds and yeasts stop growing at $a_w < 0.8$-0.88
- Enzymes can't act at a_w less than 0.85

Classes of Biomolecules

- Carbohydrates
- Lipids
- Proteins

Carbohydrates

- Sugars
- Composed of C, H, O ($C_nH_{2n}O_n$)
- Biological Uses
  - Energy source/storage
  - Structural Strength or Support
  - Tag for IDing proteins, etc.
- Monosaccharides
- Oligo- and Polysaccharides

Carbohydrates in Foods

- Sweeten (mono- and disaccharides)

- Texture (in baked goods)

- Gel formation (pectin in jams and jellies)

Starch gelation

swollen

collapsed

amylose

↓ cool

Junction zone

water
water

water

water

water

Starch gel
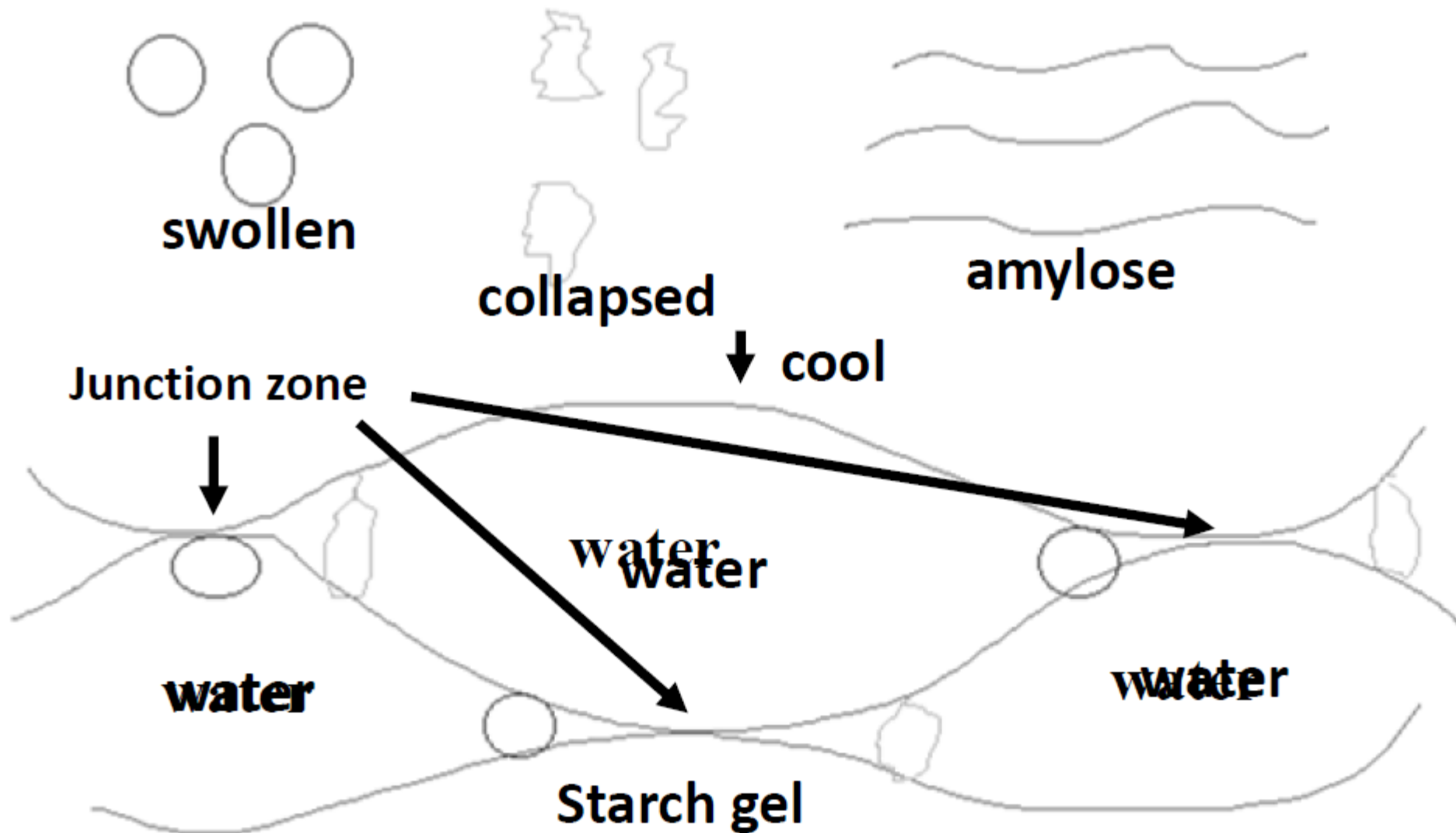
Food gums--A definition

- Non-starch, non-pectin carbohydrate polymers derived from land or sea plants, or microorganisms

  - Some representative gums include alginate, furcellaran, ghatti, karaya, psyllium seed, tamarind, xanthan, dextrans, modified celluloses, arabic, tragacanth, locust bean gum, guar gum, agar, and carrageenan

Lipids

- Hydrocarbons (largely C & H)
- Important Functions
  - Membranes! Cells, organelles
  - Energy storage (higher energy density than carbohydrates)
- Fatty acids – carbon chains with acetyl on one end
  - Saturated: no C=C (double bonds)
  - Unsaturated: Some C=C (double bonds)
- Phospholipids – hydrophobic carbon chains with hydrophillic head

Lipids in Foods

- Calories

- Texture (creaminess)

- Flavor delivery (many odor molecules are lipid soluble)

- Nutrient carrier (many vitamins are lipid soluble)

Proteins

- Proteins are linear polymers of amino acids
- Peptide bonds = amine to carboxylic acid
- Nutrients
  - Essential amino acids

- Texture

- Flavor
  - Umami

Proteins

- Polymers of amino acids-high molecular weight
  - Functions
    - Surface active agents (surfactants)
      - Good as emulsifiers
    - High water binding capacity (gelling)
      - Gelatin
    - Coagulation (gelling)
      - Milk into cheese
    - Thickening
    - Enzymatic activity
      - Many examples

Ingredient functionality example

What's in a Twix Bar?

- Milk Chocolate
  - Sugar, Cocoa Butter, Milk Ingredients, Cocoa Mass, Lactose, Soy Lecithin, Polyglycerol Polyricinoleate, Artificial Flavor
- Enriched Flour
  - Flour, Niacin, Reduced Iron, Thiamine Mononitrate, Riboflavin, Folic Acid
  - Sugar
  - Hydrolyzed Palm and Palm Kernel Oil
- Corn Syrup

What's in a Twix Bar?

- Milk Ingredients

- Dextrose

- Salt

- Cocoa Mass

- Sodium Bicarbonate

- Soy Lecithin

- Soybean Oil

- Artificial Flavor

Soy Lecithin

- Information about soy lecithin
  - Composed of phospholipids
  - Emulsifier
  - Used in chocolate and coatings to counteract "bloom"
  - Good source of choline
- Why would it be in a Twix candy bar?

Hydrolyzed Palm/Palm kernel oil

- Saturated Fatty Acid
- Stabilizer
- Why would this be a good (or a bad) thing to put in a food?
- What is hydrolysis and why would you hydrolyze something?

Ingredient Functionality

- Twix won't have ingredients just for nutritional value

- Possible reasons for an ingredient to be in food?

- What could limit water activity/extend shelf life?

Good Sources for Information About Food Ingredients

http://ndb.nal.usda.gov/

- USDA National Nutrient Database: Excellent source for nutritional information

http://www.foodprocessing.com/ingredient-glossary/

- Food Process is a trade journal with good, basic information

http://www.fda.gov/Food/IngredientsPackagingLabeling/FoodAdditivesIngredients/ucm115326.htm

- Everything added to food in the United States i.e. Food Additives

Laboratory/Design Notebook

- Bound notebook

- Record work for laboratory and design projects in this class.

- Have it by next week's lab!

Kitchen Labs Tentative Schedule (Project 2)

Lab 09: Production Lab 1 (Sunday 10/30 11am-8pm)

Lab 10: Production Lab 2 (Sunday 11/06 11am-8pm)

Lab 12: Production Lab 3 (Sunday 12/04 11am-8pm)

Teams

- Introduce yourselves to your teammates
  - Where are you from?
  - What do you like to do?
  - Etc.

- Exchange contact information (email, cell, etc.)

- See you next week!