Soy in Food: What is that doing in there?

Macromolecules: Answer Key

1. Name the FOUR cellular macromolecules. Circle the THREE which are most relevant to food composition.

Carbohydrates, Proteins, Lipids, Nucleic Acids

2. List which macromolecules you think are present in the following field crops:

Corn:
Wheat:
Soybeans:

3. If we are not able to DETECT the presence of a given macromolecule in the above crops, does the mean it is not PRESENT in the crop?
   Be sure to discuss the concept of detection limits in the context of analytical methods

Assays have detection limits, upper and lower levels outside of which the method will not work. As an example, we dilute the starch mixtures to try and get one within the detectable range. Also, just because we are not able to detect something does not mean it isn't there (oil, for some tests). However, as a general trend, if we are able to detect something in soy, for instance, but not in corn, it suggests that the levels are higher (in the detectable range) in soy.

Protocol 1: Isolation of gluten

4. What is gluten and which crop do you believe will have the most gluten?

Protein

5. If you are not able to detect gluten in your product, does that mean that it does not contain protein (why/why not)?

No, gluten is just one type of protein. That's why including a total protein analysis of some kind is important.

a. For each flour, measure 1 cup flour into each bowl and add 1 cup of water.
b. Mix vigorously with a spoon until well-dissolved. Continue to mix as gluten-containing flours will become more sticky and thick. Eventually you may need to knead some of these mixtures or mix with your hands.
c. Transfer mixture to cheesecloth and wrap the cheesecloth around the solids. Your goal is to squeeze out the liquid portion.
d. Rinse the cheesecloth bag of flour in water, working it with your hands. Gluten will be retained in the cheesecloth, while soluble proteins and starch will be washed away.
e. Record in the table below which of the flours had any gluten retained within the cheesecloth

Protocol 2: Starch detection

6. Starch is a complex form of what macromolecule?

Carbohydrate

7. Give an example of a simple version of this macromolecule:

Glucose

8. Which of the flours tested to you believe will test positive for starch?

a. For each of the three flours, add 0.5 g flour to 5 ml water
b. Transfer 1 ml of water from this first dilution to a 9 ml dilution blank. Repeat this step until you have 5 total dilutions.
c. Dip a starch strip into each tube for 1-2 seconds. Let the strip sit for 1 min.
d. Compare the strips to the chart provided. Using the strip from the highest dilution which still gives a positive result, record the approximate concentration of starch in solution.
e. In the table below, calculate the amount of starch in the original flour using the value estimated from your starch strip and the number of dilutions used.

Protocol 3: Oil Extraction

9. Why is water not used was an extraction solvent for oil?

Oil is not soluble in water

10. Which of the flours tested to you believe will have detectable oil?

a. For each of the three seeds, grind 5 g of flour using a mortar and pestle
b. Add 3 ml of acetone to the seeds and continue to grind
c. Carefully decant the liquid portion into a separate container
d. Allow the liquid to evaporate overnight so that only the oil remains
e. The following day, record the approximate volume of residual oil

Table of Results

	Gluten? (y/n)	**Total Protein**	**Starch**	**Oil**
Corn				
Wheat				
Soybeans				