## **Identification of Biological Molecules**

*Summary:* Using a number of simple tests, my group and I determined whether samples of water, whole milk, potato homogenate, soybean oil and liver homogenate contain certain biological molecules. Each substance was tested with Benedict's solution for the presence of reducing sugars, iodine solution for the presence of starch, sudan IV solid for the presence of fats, and Biuret Test Reagent for the presence of proteins. Our results showed that water does not contain any of these properties; whole milk contains sugars, fats and proteins only; potato homogenate contains sugars, starches, fats and proteins; soybean oil contains fats only; and liver homogenate contains sugars and fats only. In the case of milk, the presence of proteins is supported by the known fact that "[milk] is an excellent protein food" (*Aimutis 2004*).

*Methods & Results:* For each of the tests we measured approximately 1.0mL samples for water, whole milk, potato homogenate, soybean oil and liver homogenate and placed them into separate test tubes. The first test was to determine the presence of sugars, for which we added ~2.0mL of Benedict's Reagent to each test tube, mixed and then heated at ~100°C for three minutes. A change from clear-blue color to green, orange or red indicated a weak, moderate, or strong positive result, respectively. The second test was to determine the presence of starches, for which we added three drops of brown colored iodine to each test tube and then mixed. A resulting dark blue or black color indicated a positive result. The third test was to determine the presence of fats, for which we added a "toothpick scoop" of the crimson colored sudan IV solid to each test tube. A result of orange or red droplets indicated a positive result, while the presence of proteins, for which we added ~2.0mL of sodium hydroxide and 5 drops of 1% copper sulfate to each test tube and then mixed (the Biuret Test). A change from blue color to violet or purple indicated a positive result. Completing each of these tests produced the following results (more plus signs "+" indicate a stronger positive and NR means no reaction occurred):

	Benedict's Test	lodine Test	Sudan IV Test	Biuret Test
Water (H <sub>2</sub> O)	NR	NR	NR	NR
Whole Milk	+++ (Moderate)	NR	++ (Weak)	++ (Weak)
Potato	+++	+++++	++	++
Homogenate	(Moderate)	(Very Strong)	(Weak)	(Weak)
Soybean Oil	NR	NR	+++++ (Very Strong)	NR
Liver Homogenate	++ (Weak)	NR	+++ (Moderate)	NR

Potato homogenate was the only sample that tested positive for all four biological molecules. Unsurprisingly, pure water showed negative results in all tests. Soybean oil was expectedly high in fats while other molecules appeared to be absent. We found that the only likely discrepancy seemed to be with liver homogenate: while it tested positive for sugars and fats, no visible reaction occurred for proteins. Liver is composed of tissues and, in addition to this, one of its functions is to synthesize proteins (*Garlick & Millward & James 1973*); this proves that there was either experimental error or that a more precise method of testing is necessary to confirm these proteins.

## References:

Aimutis, W.R., 2004. Bioactive Properties of Milk Proteins with Particular Focus on Anticariogenesis, *Journal Nutrition*, 134(4), pp. 989S-995S.

Garlick, P.J. & Millward, D.J. & James, W.P.T., 1973. The Diurnal Response of Muscle and Liver Protein Synthesis *in vivo* in Meal-Fed Rats, *Biochemistry Journal* 136, pp. 935-945.