

McMush Lab

Overview

Carbohydrates, lipids, proteins, and nucleic acids are organic molecules found in every living organism. These macromolecules are large carbon based structures. The macromolecules are assembled by joining several smaller units, called **monomers**, together through a chemical reaction called dehydration synthesis. The resulting **polymer** can be disassembled through the complimentary process called hydrolysis.

Carbohydrates are used by living organisms as an important source of energy. Examples of carbohydrates include glucose, fructose, sucrose, galactose, ribose, deoxyribose, cellulose and chitin.

Lipids (Fats) Lipids are energy rich storage molecules. One gram of lipid stores twice as much energy as one gram of a carbohydrate.

Proteins are composed of amino acids. Proteins serve as the major building blocks of organisms. Proteins are large complex molecules that combine to form various components of living organisms such as muscle fibers, enzymes, and hemoglobin. Proteins are made of unique combinations of the twenty amino acid monomers. A string of amino acid monomers joined together by peptide bonds is called a polypeptide.

Nucleic Acids are RNA and DNA. **DNA** is the carrier of genetic information- specifically the code for making proteins. **RNA** aids in the process of synthesizing proteins.

Purpose

This lab activity provides an opportunity for the development of skills involved in chemically testing for the presence of the carbohydrates, lipids and proteins found in unknown substances, food and plant samples. You will learn how to test for the presence of substances using various reagents. You will apply those techniques to unknowns, plant material and a slurry that has been made by blending a complete Happy Meal (hamburger, fries and drink-not a toy ☺).

Materials

Per Team:

Unknown A	Sudan Solution	Hot Water Bath
Unknown B	Biuret Solution	Microcentrifuge tubes 5 (9 if possible)
Unknown C	Iodine Solution	Beral-type pipets (one per solution)
Unknown D	Diphenylamine Solution	Marker
Unknown E	Labels (for each solution)	McMush Slurry
Unknown plant sample		

Safety Alert

CAUTION: The reagents you will be using in the following procedures may be corrosive, poisonous, and/or irritants; they may damage clothing. Avoid skin and eye contact. If contact occurs, notify your instructor. Wear Goggles!

Procedure

Part 1. Testing Unknowns

1. Label five five microcentrifuge tubes A-E respectively
2. Add 12 drops of unknown A to tube A, 12 drops of unknown B to tube B, 12 drops of unknown C to tube C, 12 drops of unknown D to tube D and 12 drops of unknown E to tube E.
3. Start with completing the test for the presence of nucleic acids (on the following page).
4. Use a "+" to indicate a positive test and a "-" to indicate a negative test. Record results on data table 1.
5. Remove the unknowns from the tubes and thoroughly clean and rinse the microcentrifuge tubes.
6. Repeat steps 1-5 using appropriate quantities of test chemicals to test for proteins, lipids, and carbohydrates following the tests outlined on the following page.
7. Answer questions for Part I.

TEST DIRECTIONS FOR COMPOUNDS***BE VERY SURE THE LIDS OF THE TUBES ARE SNAPPED ON TIGHTLY PRIOR TO MIXING***

- **NUCLEIC ACIDS:** Mix 6 drops of an unknown with 12 drops of **diphenylamine**. Place in the hot water bath for 10 – 20 minutes. The solution will turn purple if DNA is present and green if RNA is present. ***BE VERY CAREFULL REMOVING THE TUBE FROM THE HOT WATER. USE PROPER SAFETY EQUIPMENT.*** (while it sits, you should complete another test)
- **CARBOHYDRATE:** Mix 12 drops of an unknown with 2-4 drops of iodine solution. The solution will turn from yellow-gold to blue-black if a carbohydrate (specifically starch) is present.
- **PROTEIN:** Mix 12 drops of an unknown with 5-10 drops of **Biuret** solution. The solution will turn from light blue to purple if a protein is present.
- **LIPID:** Mix 12 drops of an unknown with 5 drops of **Sudan III** and mix vigorously. The solution will turn pale yellow if no lipids are present. It will make two layers if lipids are present. The top layer containing the lipid will be pale pink to orange.

Part II. Testing Plant Tissue

1. Label 4 tubes (C for carbohydrate, P for protein, L for lipid and N for nucleic acid).
2. Fill tubes C, P and L with 12 drops of plant solution. Place only 6 drops in tube N..
3. Test the plant sample for the presence of the same key chemicals of life tested for in the above procedure (SEE TEST DIRECTIONS SECTION).
4. Record your results I data table 2.
5. Answer the questions for part II.

Part III. Testing a McDonald's Happy Meal

1. Label 4 tubes as follows. C for carbohydrate, P for protein, L for lipid and N for nucleic acid.
2. Fill tubes C, P and L with 12 drops of McMush slurry. Fill tube N with only 6 drops of McMush slurry.
3. Test each tube using the appropriate reagent and quantity (SEE TEST DIRECTIONS SECTION).
4. Record your results in data table 3. Answer questions for part III.
5. Clean Up

Clean-up

- Discard all used Pipets.
- Put clean (unused) pipets on tray.
- Wash the microcentrifuge tubes with soapy water, rinse and place on tray.
- Put the tray (clean and ready for next class) back on the lab table.
- Wash your table with a soapy cloth to remove any harmful chemicals.
- You are finished **Complete the data tables and questions and turn in.**

Name: _____

TOC# _____

McMush Laboratory Report

Expected Results “Cheat Sheet”:

	Color Before	Color after “+” test	Results
Carbohydrates + iodine			Starch present
Proteins + biuret			Amino acids present
Lipids + Sudan III			Top layer separates out lipids
Nucleic Acids + diphenylamine			DNA or RNA present

Experimental Results:

Record your results using a “+” for a positive test and a “-“ for a negative test.

Part I:

Table 1 – Reagent Tests of Unknowns

Unknown	Carbohydrate	Protein	Lipid	Nucleic Acid
A				
B				
C				
D				
E				

1. How did you determine the identity of each unknown?

2. What do you know about each unknown?

Name: _____

TOC# _____

Part II:

Table 2 – Analysis of Compounds in Plant Material

Plant Material	Carbohydrate	Protein	Lipid	Nucleic Acid
Bean Solution				

3. How did you test for the presence of chemicals?
4. What was the plant tissue composed of?

Part III

Table 3- Analysis of Compounds in McMush Slurry

McMush	Carbohydrate	Protein	Lipid	Nucleic Acid
Blended Happy Meal				

5. Were you surprised by the results of any of your tests? Explain.
6. What components were present in the McMush solution?
7. Which parts of the Happy Meal probably contained these compounds?
8. What is the function of each of the 4 compounds of life?