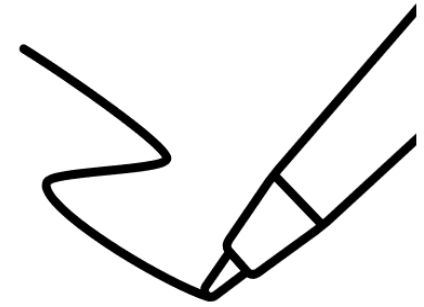


A close-up, top-down view of a large pile of fast-food items. The items are densely packed and include several burgers with sesame seed buns, golden-brown french fries, two slices of pepperoni pizza, fried chicken pieces, onion rings, and a salad with shredded lettuce and a tomato slice. The overall color palette is warm, dominated by the browns of the fried food and the reds of the pizza and tomatoes.

# Macromolecules

# Quick Write: 60 seconds



On a scrap sheet of paper answer this question:

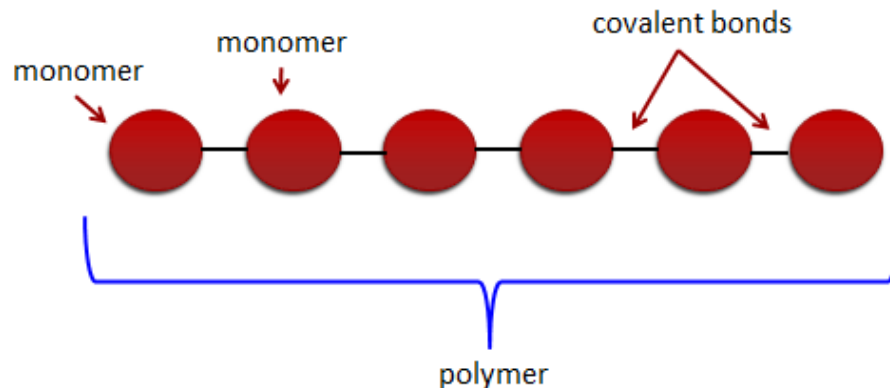
- Is what you eat important? Why?

# Macromolecules

- Food that you eat is made of macromolecules
- Macromolecules are large molecules that are critically important to all living things.
- “Macro” means large
- Your body breaks down these macromolecules and uses them build other essential molecules in your body

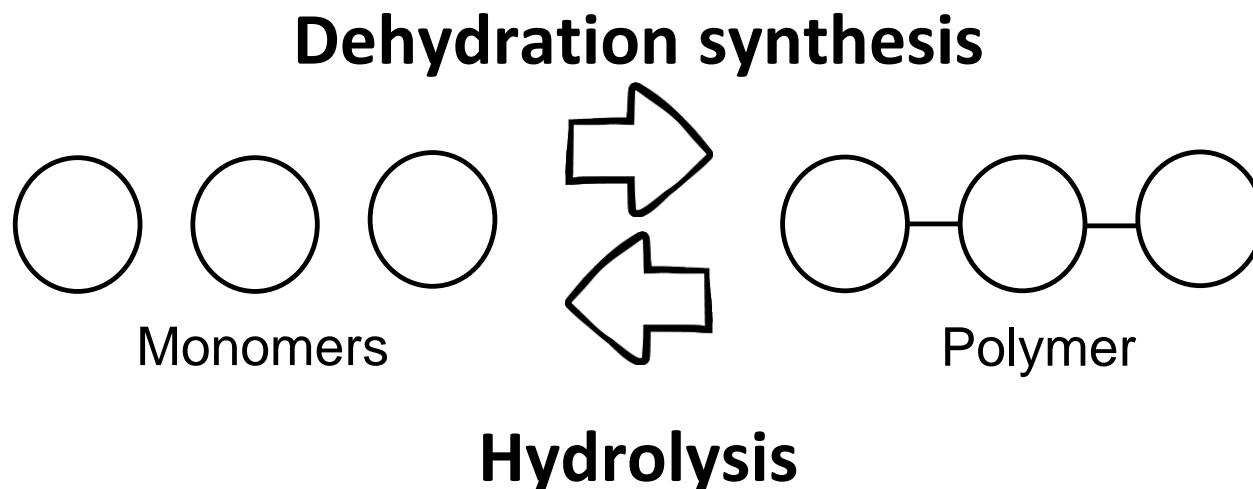
# Macromolecules

- Most macromolecules are made of smaller units called monomers
  - “mono”=one “mer”=part
- Monomer is one unit of a macromolecule
- These monomers join together to form polymers
  - “poly”= many “mer”= parts
- Polymer is a strand of many monomers
- Monomers are like beads and the polymers are like a necklace



# Making and Breaking Macromolecules

- Joining monomers happens through a process called **dehydration synthesis**
  - Removing a molecule of water to create a bond
- Breaking down a polymer occurs through **hydrolysis**
  - Adding a molecule of water to break a bond



# Think Pair Share

- Imagine you are a nutritionist. Your job is to advise people on the most nutritious food to eat.
- Make a list of food you would recommend.
- Then compare your list with your partners'.

# Types of Macromolecules

- If you have ever looked at a nutrition label before, you will recognize some of these terms
- Type of macromolecules:
  - Carbohydrates
  - Lipids
  - Proteins
  - Nucleic Acids



# Carbohydrates

- **Elements:** Carbon, Hydrogen, Oxygen (CHO)
- **Monomers:** Monosaccharide
  - Mono= one, saccharide= sugar
- **Function:** Energy and structure
- **Examples:**
  - Sugar
  - Starch
  - Fiber
- Hint: most end in -ose!





# Carbohydrates-Types

Carbohydrates differ by how many monomers they have:

- Monosaccharides- 1 sugar

- Ex: Glucose



- Disaccharides- 2 sugars

- Ex: Sucrose



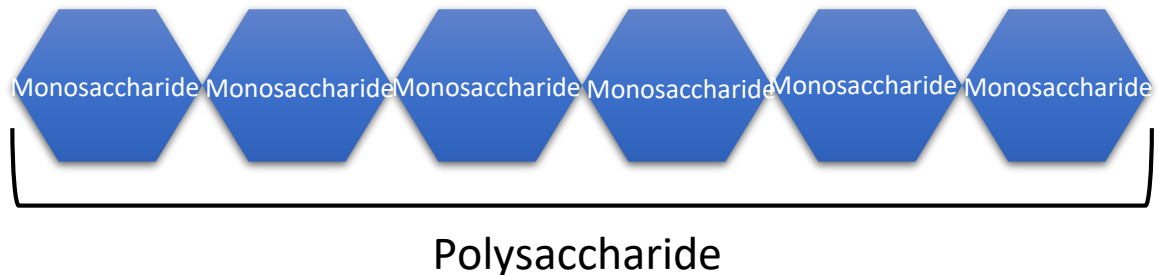
- Polysaccharides- Many sugars

- Starch

- Glycogen

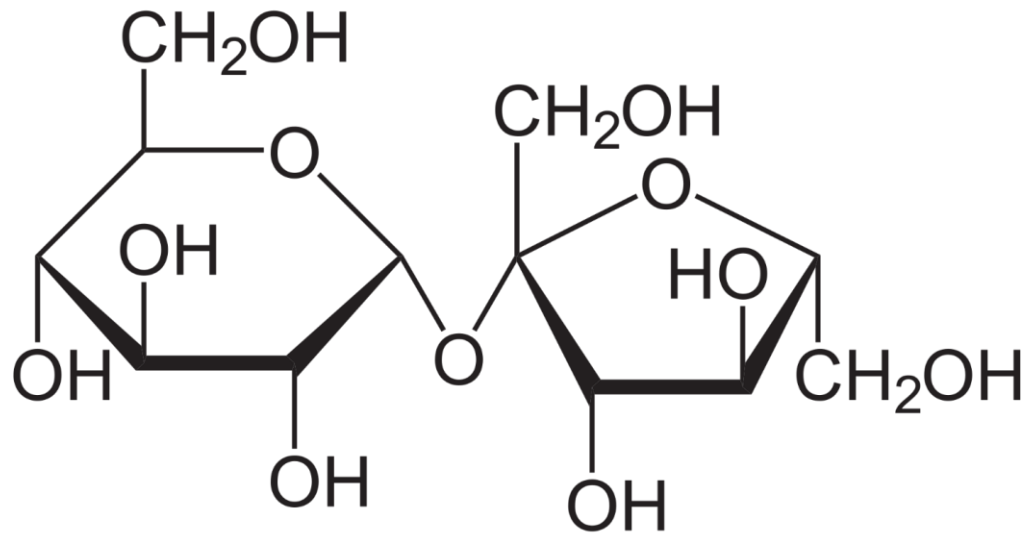
- Cellulose

- Chitin



# What type of carbohydrate?

Monosaccharide, Disaccharide, or Polysaccharide?



Disaccharide!

This is sucrose AKA table sugar

# Foods high in Carbohydrates

- Candy
- Fruits
- Pasta
- Bread

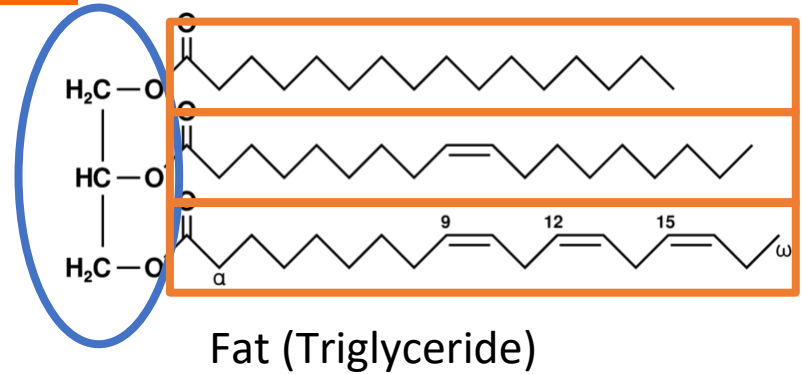


# Lipids

- **Elements:** Carbon, Hydrogen, Oxygen (CHO)
- **Types:** triglycerides, phospholipids, steroids
- **Common parts:** Glycerol, fatty acids
- **Function:** Energy storage, forms cell membranes, body insulation
- **Examples:**
  - Fats
  - Oils
  - Waxes
  - Steroids
- \*All lipids are hydrophobic- Do not mix with water!

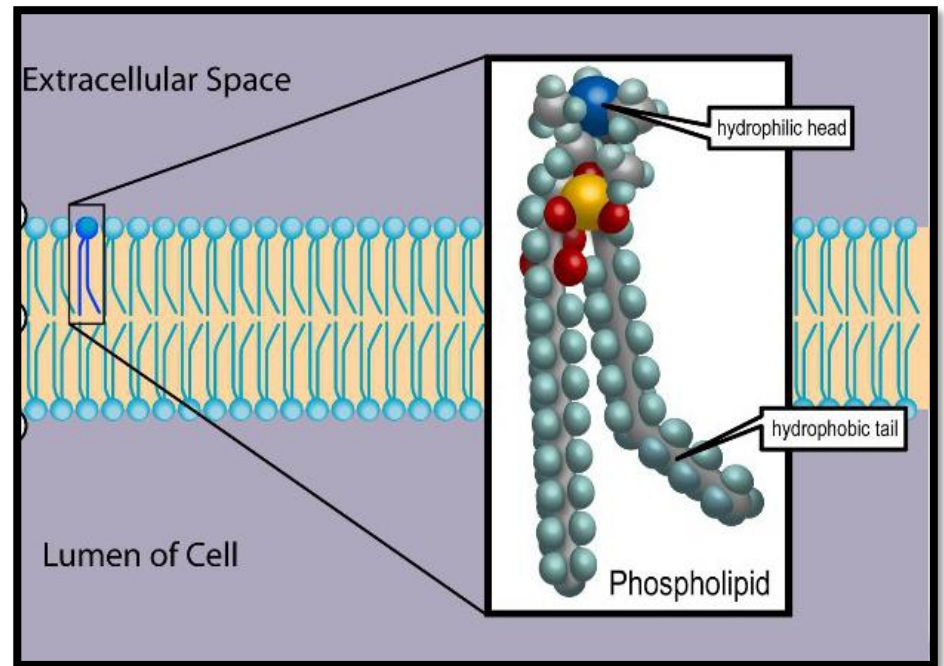
# Lipids: Fats

- Fats: AKA Triglyceride
  - 1 glycerol
  - 3 fatty acids
- Function: Energy Storage
  - More energy than carbs!
- Fats can be:
  - Saturated
    - Solid at room temperature
    - Ex: Butter
  - Unsaturated
    - Liquid at room temperature
    - Ex: Oil



# Lipids: Phospholipids

- Forms the cell membrane of cells
- Glycerol + phosphate group + 2 fatty acids
- Has two parts:
  - **Head- Hydrophilic**
  - **Tail- Hydrophobic**





# Foods high in Lipids

Some are good and some are not

- Oils

- Vegetable oil
- Olive oil ✓
- Coconut oil

- Fats

- Butter
- Cheese
- Meats (bacon)
- Avocado ✓
- Nuts ✓



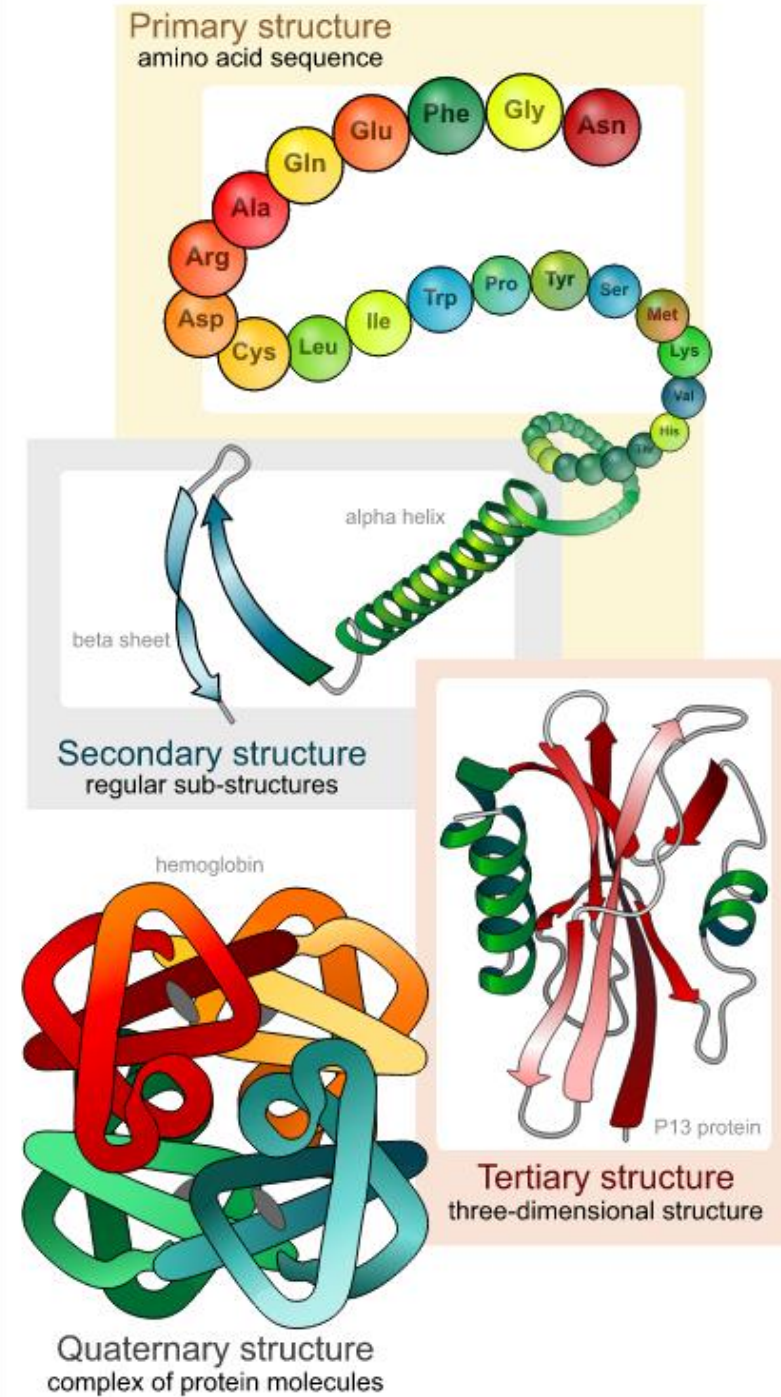
Which of these do you think are the best for you?

# Protein

- **Elements:** Carbon, Hydrogen, Oxygen, Nitrogen (CHON)
- **Monomers:** Amino acids
- **Function:** (A little bit of everything) muscle contraction, cell transport, enzymes\*
- **Examples:** insulin, keratin, melanin
- (Hint: a lot of proteins end with -in)

# Protein Structure

- There are 20 common amino acids that can link together to form proteins
- Long chains of amino acids are called polypeptides
- Polypeptides fold into a protein



# Foods high in Protein

- Meats
- Nuts
- Eggs
- Beans



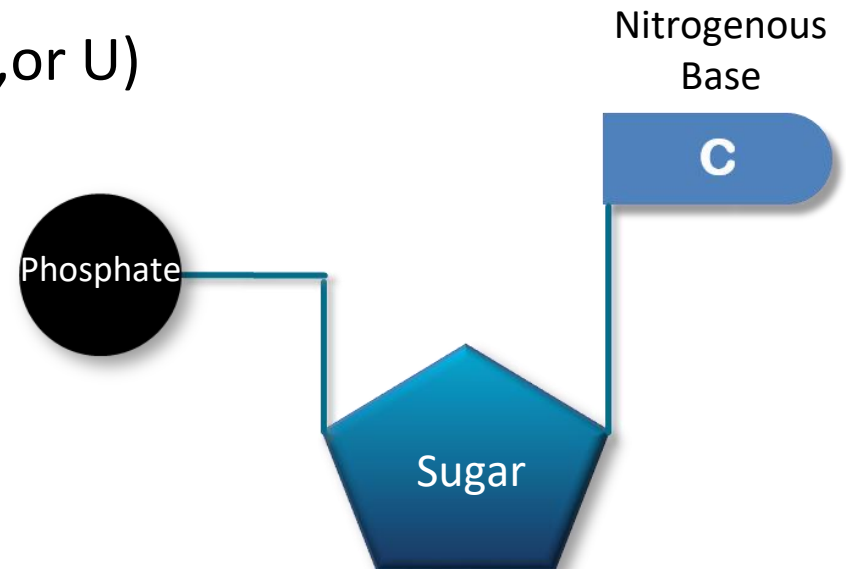
# Nucleic Acids

- **Elements:** Carbon, Hydrogen, Oxygen, Nitrogen, Phosphorous (CHONP)
- **Monomers:** Nucleotides
- **Function:** Storing and transmitting instructions to make proteins
- **Examples:** DNA and RNA

(We will discuss these in detail during our genetics unit)

# Nucleic Acids

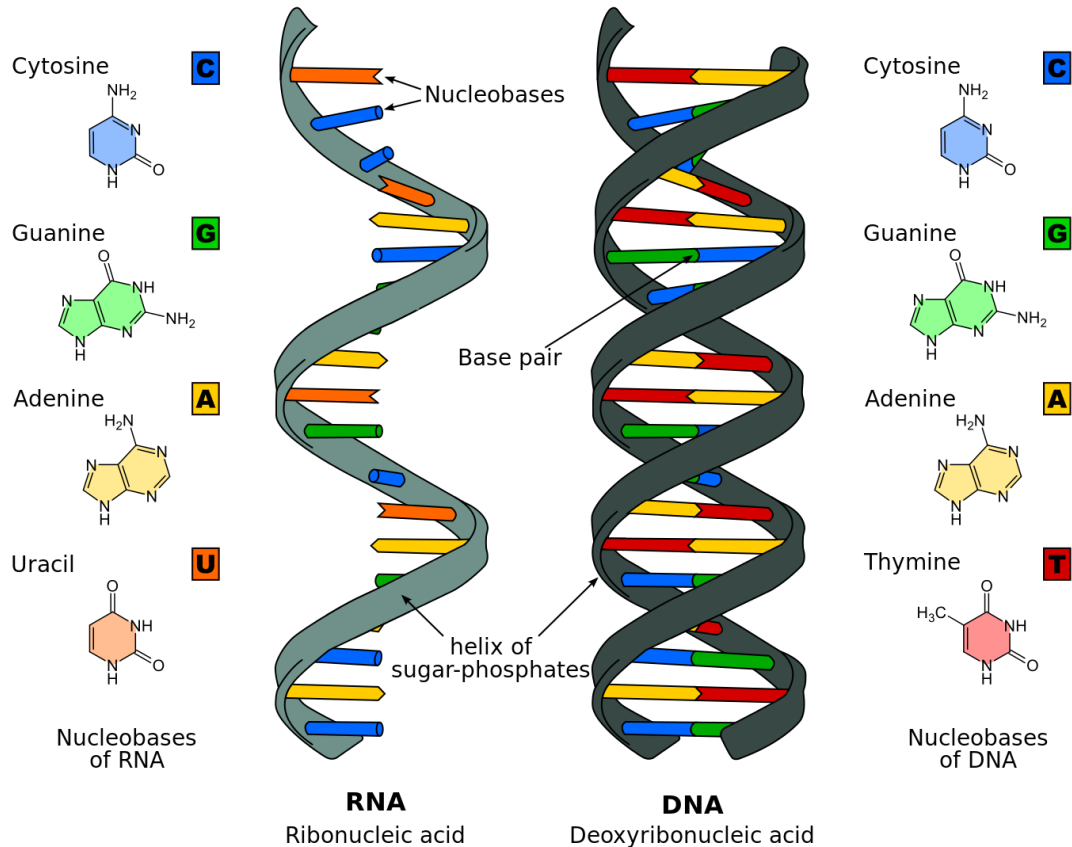
- The monomer of nucleic acids are nucleotides
- Three parts
  - A sugar
  - A phosphate group
  - A nitrogenous base (A,T,G,C,or U)





# DNA vs. RNA

- DNA is double stranded
- RNA is single stranded



# Food and Nucleic Acids

- All living things have DNA and/or RNA
- Therefore, all food has nucleic acids
- It is not included in nutritional labels

# Nutritional Label

Lipids

Carbohydrates

Proteins

## Nutrition Facts

8 servings per container

**Serving size** 2/3 cup (55g)

**Amount per serving**

**Calories** **230**

**% Daily Value\***

**Total Fat** 8g **10%**

Saturated Fat 1g **5%**

*Trans* Fat 0g

**Cholesterol** 0mg **0%**

**Sodium** 160mg **7%**

**Total Carbohydrate** 37g **13%**

Dietary Fiber 4g **14%**

Total Sugars 12g

Includes 10g Added Sugars **20%**

**Protein** 3g

Vitamin D 2mcg 10%

Calcium 260mg 20%

Iron 8mg 45%

Potassium 235mg 6%

\* The % Daily Value (DV) tells you how much a nutrient in a serving of food contributes to a daily diet. 2,000 calories a day is used for general nutrition advice.

*Who Killed the Food Critic?*

**Macromolecule  
Murder Mystery**



# Macromolecule Lab: The Last Meal

- Scenario: The local law enforcement agency finds a notorious food critic dead in his home. After interviewing his wife, they discover that he had visited three restaurants earlier that day for breakfast, lunch, and dessert. The detectives went to each restaurant and interviewed the chefs. Your lab sheet contains the information that they received.







# Macromolecule Lab: The Last Meal

We will be answering the question:  
“Who killed the food critic”

- Research the nutrient facts for the food the food critic ate the day of his death.
- Remember to add the whole meal’s nutrient facts together.
- Write the information here
- Then circle to two macromolecules that make up most of the meal



 **The Last Meal**   
A Macromolecule Lab Investigation

The local law enforcement agency finds a notorious food critic dead in his home. After interviewing his wife, they discover that he had visited three restaurants earlier that day for breakfast, lunch, and dessert. The detectives went to each restaurant and interviewed the chefs. Here is the information they received:

- 1. Breakfast: Little Bobby's Bistro**  
Chef and owner Bobby remembered seeing the food critic that morning. He said that the victim ordered bacon and eggs, which he complained were over-cooked and too salty. That wasn't the first negative comment he made about Little Bobby's food. The victim had previously stated that "Little Bobby's Bistro was the best at ruining the most important meal of the day."
- 2. Lunch: Luisa's Italian Kitchen**  
Luisa recently took over the restaurant after her mother died. She remembered the food critic victim because he repeatedly gave her mother's food bad reviews. Luisa said that the victim ordered a pesto pasta dish. He told the waiter that the pasta was drowning in olive oil.
- 3. Dessert: Sally's Sundaes**  
Sally has always loved making ice cream. Even after the food critic gave her a 1 out of 5 review last year saying, "Congratulations, you made it possible for me to hate ice cream," her spirits are still high. She told the detectives that the victim ordered a brownie and ice cream sundae. The ice cream gave him a brain freeze and he said the brownie was bland.

The crime scene investigators found vomit in the victim's car. They believe whatever food caused him to vomit was poisoned and likely caused his death. The CSI sent the vomit here to be analyzed. You will be testing for macromolecules found in the vomit to determine which food caused him to throw up.

Under each of the suspects below, list what food the victim ate at their restaurants and what macromolecules (carbohydrates, lipids, or proteins) would be found in each:

	<b>Bobby:</b>	<b>Luisa:</b>	<b>Susan:</b>
Ordered Food:			
Macromolecules in food:			



# Nutrient Facts: Macromolecules

## Bacon & Eggs

Fat: 8.3g  
Protein: 9g

## Pesto Pasta

Complex  
Carbs: 16g  
Fat: 14g

## Brownie Ice Cream

Simple  
Carbs: 62g  
Fat: 17g

These are the main macromolecules in each of the meals. We will be testing the vomit to see which combination of macromolecules is present. The macromolecules we test positive for will lead us to the killer!

Numbers may vary slightly

# Check it:

Little Bobby:

Luisa:

Susan:

**Ordered  
Food:**

Bacon and Eggs

Pesto Pasta

Brownie and  
ice cream

**Macromolecules  
in food:**

Protein and  
Lipids

Complex  
carbohydrates  
and Lipids

Simple  
carbohydrates  
and Lipids

	Bacon and Eggs	Pesto Pasta	Brownie and ice cream
	Protein and Lipids	Complex carbohydrates and Lipids	Simple carbohydrates and Lipids

# Testing for Macromolecules

- Now we need to learn about the 4 tests we will use to test for simple carbs, complex carbs, lipids, and proteins.
- Take some time to research tests that can identify simple carbohydrates, complex carbohydrates, lipids and proteins.
- Then, complete page 2 of your student lab sheet.



1. Before the lab: Who do you think killed the food critic? Why?

Today you will be working in groups in order to answer the question: **Who killed the food critic?** Each group will get a sample of the vomit to analyze. You will test the sample for the presence of macromolecules: simple carbohydrates, complex carbohydrates, proteins, and lipids. The results of these tests will indicate which meal caused the food critic to throw up, and ultimately who killed him.

**Testing for Macromolecules:** Before we get started, you need to understand how to test for macromolecule. Answer the questions below.

1. Test for simple carbohydrates: **Benedict's Solution**

What are simple carbohydrates?

Positive test: \_\_\_\_\_  
(has simple carbs)

Negative test: \_\_\_\_\_  
(no simple carbs)

---

2. Test for complex carbohydrates: **Iodine**

What are complex carbohydrates?

Positive test: \_\_\_\_\_  
(has complex carbs)

Negative test: \_\_\_\_\_  
(no complex carbs)

---

3. Test for lipids: **Sudan IV**

What are lipids?

Positive test: \_\_\_\_\_  
(has lipids)

Negative test: \_\_\_\_\_  
(no lipids)

---

4. Test for Proteins: **Biuret Reagent**

What are proteins?

Positive test: \_\_\_\_\_  
(has proteins)

Negative test: \_\_\_\_\_  
(no proteins)

# Macromolecule Tests

## Benedict's Solution

Tests for:

Simple Carbs  
(sugars)

Positive Test:

Green, Red,  
Orange

Negative Test:

Light Blue

## Iodine Solution

Tests for:

Complex Carbs  
(starches)

Positive Test:

Dark purple,  
Black

Negative Test:

No color change

## Sudan IV Stain

Tests for:

Lipids  
(fats)

Positive Test:

Fat turns red

Negative Test:

No color change

## Biuret Reagent

Tests for:

Proteins

Positive Test:

Purple

Negative Test:

No color change

# Lab

- You will be working in lab groups today to solve who killed the food critic
- Lab safety is important!
- Wear goggles and handle glassware and chemicals carefully
- Read all directions before you ask a question
  - Remember: Ask 3 before me!
- Leave the lab the way you found it.

# Conclusion

## The Killer: Luisa

Luisa put her life work into her Italian kitchen. When the food critic came into her restaurant, she immediately remembered him from the terrible reviews that he gave her mother when she ran the restaurant. Her mother took those reviews to heart and never was able to regain the customers that she lost because of those reviews!

When the food critic came in, Luisa poisoned his pesto pasta dish. She was glad she did because, before he left, he announced loudly that the pesto pasta was drowning in olive oil. This caused several customers that were waiting for a table to leave.

