The Last Supper: Identifying Macromolecules

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Focus on Inquiry

The students will solve a mystery using laboratory tests for different types of macromolecules. They will use argumentation to justify and communicate their claim. They will construct explanations and communicate with one another to determine which macromolecule would be best to eat in different scenarios.

Lesson Content Overview

Students will be able to identify the structure and functions of the four main types of macromolecules. The students will use laboratory testing to determine the identity of an unknown. They will fill in a chart about the structures, functions, and examples for each macromolecule type and then they will practice their knowledge by answering short response questions relating the macromolecules to the real world. Finally, they will review using a whole-class cooperative activity and take a quiz about the structures and functions of macromolecules.

Duration	Setting	Grouping	PTI Inquiry Subskills
100 minutes	Classroom	2-4 students/group	1.3, 2.1, 2.5, 3.1, 3.3, 3.4, 3.5, 3.7,4.2, 4.3, 5.2, 5.3, 5.4, 5.6, 5.7, 5.8, 6.1, 6.2, 7.2, 7.3

Lesson Components	Estimated Time	*Inquiry Subskills Used*	Technology Used	Level of Student Engagement	Brief Description
Engage	4 min	5.2	Computer/projector	2	Students will view a real-time video, https://www.youtube.com/watch?v=3AUlUH4-13Q, about what happens in the stomach when a person eats. They will then do a rally robin with their shoulder partner to begin thinking about why the video was shown
Explore	15 min	1.3, 2.1, 2.5, 3.1, 3.3, 3.5, 3.7,4.2, 4.3, 5.2, 5.3, 5.4	None	3	Students will use given information to design a and carry-out a procedure to solve a forensic scenario
Explain	25 min	5.2, 5.3, 5.4, 5.6, 5.7, 6.1, 6.2, 7.2, 7.3	none	3	Students will then use a "claim-evidence-justification" board and a round-robin activity to communicate their findings to the other students in the class.
Expand Elaborate	30 min	3.3, 3.4, 4.2, 5.8, 7.3	none	2	Students will use available sources to fill in chart about the form and function of each of the four main types of macromolecules. They will answer short response questions relating macromolecules to their use in real life situations.
Evaluate	15 min (pt 1--TTS) 10 min (pt. 2--quiz)	7.3	none	3	Students will do a whole-class cooperative activity, Test-Test-Swap, to review. Students will take a quiz about the structure and function of macromolecules

Level of Student Engagement

1	Low	Listen to lecture, observe the teacher, individual reading, teacher demonstration, teacher-centered instruction
2	Moderate	Raise questions, lecture with discussion, record data, make predictions, technology interaction with assistance
3	High	Hands-on activity or inquiry; critique others, draw conclusions, make connections, problem-solve, student-centered

Next Generation Science Standards – Inquiry

NGSS Practice 1: Asking Questions and Defining Problems
NGSS Practice 2: Developing and Using Models
NGSS Practice 4: Analyzing and Interpreting Data

NGSS Practice 6: Constructing explanations
NGSS Practice 7: Engaging in arguments from evidence
NGSS Practice 8: Obtaining, Evaluating and Communicating Information

Next Generation Science Standards – Life Science

HS-LS1-2.: Construct and revise an explanation based on evidence for how carbon, hydrogen, and oxygen from sugar molecules may combine with other elements to form amino acids and/or other large carbon-based molecules.

Florida Science Standards – Nature of Science

SC.912.N.1.1: Use tools to gather, analyze, and interpret data (this includes the use of measurement in metric and other systems, and also the generation and interpretation of graphical representations of data, including data tables and graphs). Collect data or evidence in an organized way. Pose answers, explanations, or descriptions of events. Generate explanations that explicate or describe natural phenomena (inferences). Use appropriate evidence and reasoning to justify these explanations to others. Communicate results of scientific investigations, and evaluate the merits of the explanations produced by others.
SC.912.N.1.6: Describe how scientific inferences are drawn from scientific observations and provide examples from the content being studied.

Florida Science Standards – Content

SC.912.L.18.1: Identify basic molecular structures and describe the primary functions of the four major categories of biological macromolecules,
SC.912.L.18.2: Describe the important structural characteristics of monosaccharides, disaccharides, and polysaccharides and explain the functions of carbohydrates in living things.
SC.912.L.18.3: Describe the structures of fatty acids, triglycerides, phospholipids, and steroids.
SC.912.L.18.4: Explain the function of lipids in living organisms. Identify some reactions that fatty acids undergo. Relate the structure and function of cell membrane.

Materials and Advance Preparation

Materials List

Class/Group Sets:

- Computer and projector (or other means of showing video clip)
- Blackline Master #1 (1 per group)
- Goggles (1 per person)
- Gloves (1 set per person)
- Disposable pipettes or droppers (1 per group)
- Stir rods or popsicle sticks (3 per group)
- 4 spoonful's of stomach content (vomit) per group
- 10 drops Benedicts solution per group
- 10 drops of Iodine solution per group
- 10 drops of Biuret solution per group
- 250 mL Beaker for hot water bath (1 per class)
- Hot water bath (1 per class)
- 50 mL Beakers or plastic cups (3 per group)
- 3in. x 3in. square of brown paper bag (1 per group)
- Blackline Master #3 (1 per group)
- Blackline Master #4 (1 per group)
- Chart paper or poster board or large dry-erase board (1 piece per group)
- Fan and Pick Cards (Blackline Master #7--1 set per group)
- Ingredients list from minestrone soup used to make stomach contents (vomit)
- Test-Test-Swap Cards (Blackline Masters #8--1 set for whole class)

Student materials:

- Blackline Master #2 (1 per student)
- Blackline Master #5 (1 per student)
- Blackline Master #6 (1/2 sheet per student)
- Blackline Master #9 (1 per student)

Blackline Masters

1. Blackline Master #1: Lab Sheet with Premise and Procedures
2. Blackline Master #2: Student Lab Sheet
3. Blackline Master #3: Autopsy Report
4. Blackline Master #4: Claim, Evidence, and Justification Worksheet
5. Blackline Master #5: Structure and Function Chart
6. Blackline Master #6: Macromolecule Structure Cut-outs
7. Blackline Master #7: Fan and Pick Cards
8. Blackline Master #8: Test-Test-Swap Cards
9. Blackline Master #9: Macromolecule Structure and Function Quiz

Advance Preparation

1. Find link for engage video and prepare AV equipment to show video: https://www.youtube.com/watch?v=3AUlUH4-13Q.
2. Cut out a piece of a brown paper bag to the size of about 3in. by 3in. (one for each group).
3. Prepare the stomach contents- Puree (in a blender) 1 can of minestrone soup and 30 ml of vegetable oil.
4. Prepare solutions needed for lab tests (Biuret, Benedicts, and iodine solutions)
   Note: diluted iodine soap (i.e. Betadine) will produce positive results
   Glucose urinalysis test strips may be used in place of Benedict's test
5. Prepare lab stations with necessary lab equipment prior to students arriving.
6. Make sure you have enough chart paper, poster boards, or large dry-erase boards for each group.
7. Make copies of the following:

   a. **Blackline Masters #1 (1 per group)**
   b. **Blackline Master #2 (1 per student)**
   c. **Blackline Master #3 (1 per group)**
   d. **Blackline Master #4 (1 per group)**
   e. **Blackline Master #5 (1 per student)**
   f. **Blackline Master #6 (1/2 sheet per student)**
   g. **Blackline Master #7 (1 per group)**
   h. **Blackline Master #8 (1 set for class)**
   i. **Blackline Master #9 (1 per student)**

8. Cut Fan and Pick cards (**Blackline Master #7**) apart into individual questions and put in sets (1 per group).
9. Prepare Test-Test-Swap cards (**Blackline Masters #8**) by cutting each paper into 3 strips horizontally (3 questions) then fold on the dotted line, and staple. This will make 30 cards with a question on the front and answer on the back.

Lesson Information

Learning Objectives

1. The student will be able to describe and identify the basic structures of carbohydrates, lipids, proteins, and nucleic acids.
2. The student will be able to describe the primary function of carbohydrates, lipids, proteins, and nucleic acids in organisms.
3. The student will be able to relate the functions of macromolecules to real-life scenarios.

Prior Knowledge Needed by the Students

- Students will need to know and understand basic laboratory safety protocols.
- Students will need to understand what an indicator is and why it would be used in a science laboratory.

Background Information

Carbohydrates are composed of chains of carbons attached to oxygen and hydrogen. Carbohydrates provide quick energy (monosaccharide), serve as an energy reserve (polysaccharides), and is an important component of cell membranes. Carbohydrates are grouped into three categories based on the number of saccharide units that are characterized as a five or six ringed structure.

Monosaccharides, like glucose and fructose, are composed of one saccharide unit (quick energy). Disaccharides, like table sugar (sucrose), are composed of two units and must be broken down by enzymes to utilize for quick energy.

Polysaccharides, like starch and glycogen (storage form of glucose in muscle and liver), are composed of many units. Polysaccharides are used by athletes before athletic events.

Lipids, like carbohydrates, are composed of carbon, hydrogen, and oxygen. Common lipids found in plants and animals are various fats and oils, waxes, phospholipids, steroids, and cholesterol. These lipids represent stored and long term energy or may be used to produce cell structures or substances. Lipids are insoluble in water.

Proteins are made by joining many smaller monomers called amino acids. These are composed of carbon, hydrogen, oxygen and nitrogen. Proteins are found in the membranes (peripheral and integral) and in the cytoplasm of all cells. All enzymes are proteins and many hormones as well.

DNA (deoxyribonucleic acid) is a very large, complex macromolecule structured like a ladder that has been twisted into a spiral. The outer edges of the ladder are made up of deoxyribose sugars and phosphates. The "rungs" of the ladder are composed of nucleotide bases (guanine, cytosine, adenine, and thymine) that are arranged in a specific sequence. It is the order of these nucleotide base pairs that determines the instructional code carried by the DNA for genetic information and protein synthesis.

Lesson Procedure

Engage (Day 1)

1. Students will watch video clip https://www.youtube.com/watch?v=3AUlUH4-13Q, "Inside a stomach- Guts: the Strange and Mysterious world of the human stomach"--BBC Four (Time-3:06)
2. With a shoulder partner quickly discuss (around 30 seconds each) the highlights of the video and possibly why it was shown.

Explore (Day 1)

1. Distribute a set of **Blackline Master #1** to each group. Distribute a **Blackline Master #2** to each student.
2. Read through the scenario (**Blackline Master #1**) as a whole class.
3. In lab groups, split the 4 tests amongst the lab group members.
4. Students will perform each lab test and record the results in the data charts (**Blackline Master #2**)
5. Students will then properly dispose of stomach contents (vomit) and wash lab materials thoroughly with soap and water. Clean lab station.
6. Check to make sure all group members share and report all parts of each test onto data charts.
7. Possible answers to data charts are included on **Blackline Master #2 KEY**

Explain (Day 1)

1. Distribute one **Blackline Master #3** to each group.
2. As a group, the students will transfer their results to the result box on **Blackline Master #3** and complete the rest of the report.
3. Possible answers to the chart on **Blackline Master #3** can be found on **Blackline Master #3**.

4. Distribute one **Blackline Master #4** and a piece of chart paper, poster board, or large dry erase board to each group.
5. Each group will then complete the **Blackline Master #4** and then transfer the information to a piece of chart paper (or poster board or large dry-erase board).
6. Allow each group 10 minutes to complete the form and transfer the information to the chart paper.
7. An example of what their "claim, evidence, justification sheet should look like is included on **Blackline Master #4 Key**.
8. Using the "One Stray" structure, students will rotate to other groups and discuss/defend their claim and justification. The other groups should provide feedback as needed. Each rotation should be timed for 2 minutes.
9. After each group has rotated around to all the other groups, allow 2 minutes for each group to discuss and/or revise their group's results depending on the discussions that occurred during the rotations.
10. The teacher will list the ingredients found in the minestrone soup that was used in the experiment and then lead a class discussion from the possible questions below:

    a. Name the four type of macromolecule found in the minestrone soup.
       Answer: Carbohydrate, nucleic acid, protein and lipids.
    b. Think about what you ate this morning and name one carbohydrate.
       Example: Cereal and milk, which is a carbohydrate.
    c. What type (name one) of macromolecule is found in every ingredient of the minestrone soup?
       Answers: DNA (found in all cells)
    d. True or false: carbohydrates, fats, and proteins are all essential nutrients to animals.
       Answer: True
    e. Would you consider a candy bar as the main source of long term energy?
       Answer: No, short term energy
    f. Name all ingredients that can be labeled carbohydrates in the minestrone soup.
       Answer: Pasta, vegetable etc.…
    g. Which macromolecule is needed by animals that hibernate for long periods of time?
       Answer: Lipids
    h. Would you consider an enzyme a protein, carbohydrate or lipid?
       Answer: Protein
    i. Name a food that has a good amount of proteins in it.
       Answer: Any meats
    j. What macromolecule(s) can we find in the nucleus of a cell?
       Answer: Nucleic Acids (DNA)

Expand (Day 2)

1. Distribute **Blackline Master #5** and ½ of **Blackline Master #6** to each student.
2. Students will use a variety of sources (i.e. textbooks and internet) to fill in the **Blackline Master #5.** Students can cut out the structure of each macromolecule and paste it in the chart.
3. Students should be given approximately 15 minutes to complete the chart.
4. During the time students are working on the chart, teacher should circulate throughout the room and check for understanding. Possible questions and answers may be:
    a. Looking at the different structures of the four macromolecules, what structures "stand out" (or are significantly different) from the others? *Carbohydrates are in an octagon shape, lipids tend to be in long chains, nucleic acids have three parts, and proteins are the most varied in shape.*
    b. According to your chart, what are some characteristics you can look for to identify proteins? *"R" group, Carboxyl group C=O, and Nitrogen.*
    c. What element is in all carbohydrates, proteins, and lipids? *Carbon*
    d. If a compound contains carbon, what is it considered? *Organic*

e. If a person is a bodybuilder and works out every day, what macromolecule would he/she want to increase in his/her diet? Why? What types of foods should he/she eat? *Proteins – One function of proteins is to repair tissues-when you work against resistance muscle fibers may "tear" slightly. Foods that a person can consume are meat, fish, nuts, yogurt, beans, cheese, and eggs.*
f. What is the function of nucleic acid? What molecule is responsible for this? *Transmit genetic information – DNA*

5. Answers for the chart are included on **Blackline Master #5**.
6. Each group of 4 students receives a set of questions from **Blackline Master #7**.
7. Students will use a Fan and Pick structure to complete the scenario questions.
8. Possible answers to scenario questions are on **Blackline Master #7**.

Evaluate

Informal/Formative Evaluation

1. Macromolecules Test-Test-Swap cards – **Blackline #8** (10 Pages, 30 cards total)
   a. Pass one Test-Test-Swap card to each student.
   b. Students will use the stand-up, hand-up, pair up structure to meet with different classmates to quiz each other and then trade cards. Students will continue until the teacher calls time (approximately 10 minutes).

Formal/Summative Evaluation

1. Macromolecules Check for Understanding – **Blackline Master #9**
2. Macromolecules Check for Understanding Answer Key – **Blackline Master #9**

Supplementary Resources:

- **For Teachers:**
  - Reading: Different Types of Biological Macromolecules (at courses.lumenlearning.com) https://courses.lumenlearning.com/bio1/chapter/reading-biological-macromolecules/ **Authored by**: Shelli Carter and Lumen Learning. **Provided by**: Lumen Learning

- **For Students:**
  - ***Biological Molecules - You Are What You Eat: Crash Course Biology #3*** (2012, February 13). Retrieved September 12, 2016, from https://www.youtube.com/watch?v=H8WJ2KENlK0&list=PL3EED4C1D684D3ADF&index=3
  - ***Biomolecules (Updated): Amoeba Sisters*** (2016, February 11). Retrieved September 12, 2016, from https://www.youtube.com/watch?v=YO244P1e9QM&index=3&list=PLwL0Myd7Dk1F0iQPGrjehze3eDpco1eVz

CITATION OF SOURCES.

1. Autopsy Form - Fill Online, Printable, Fillable, Blank | PDFfiller. (n.d.). Retrieved September 12, 2016, from https://www.pdffiller.com/13379544-fillable-autopsy-form-ttuhsc
2. "Inside a Stomach - Guts: The Strange and Mysterious World of the Human Stomach"; (2012, July 06). Retrieved September 12, 2016, from https://www.youtube.com/watch?v=3AUlUH4-13Q%2C

Image Sources:

3. Wikimuzg. (2005). Glucose Fisher to Haworth. https://commons.wikimedia.org/wiki/File:Glucose_Fisher_to_Haworth.gif
4. Dallas Learning Cloud. (2017). Lipid Structure. https://dlc.dcccd.edu/biology1-3/lipids

5. Benjah-bmm27. (2007). Protein Structure. https://commons.wikimedia.org/wiki/File:Alpha-amino-acid-2D-flat.png

__✓__ Yes, I cited all materials and resources used in this lesson.

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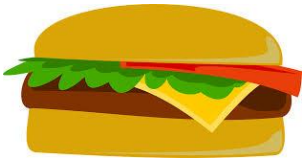
Lesson authors' signature

The Last Supper

The Case:

You are walking along the beach after dinner, sometime after 9:00pm in Daytona Beach, FL. You come across detectives at a crime scene of a young woman (Jane Doe). The detectives have asked you (a forensic pathologist on vacation) to assist in determining the cause of death and the individual(s) responsible. In order to identify the victim and the individual who committed the crime, you need to question all the individuals whom the victim came in contact with the day before. Near the victim there was a substantial amount of body fluids (vomit). In order to gain more information about the victims last know location, you need to analyze the body fluid (vomit) to identify at which establishment the victim had eaten. The detectives have found receipts in the victims' purse from the following restaurants:



Burger Mania
The victim loved to eat burgers with her friends at Burger Mania.
What macromolecules would you expect to find in the stomach contents of the victim if the victim's final meal was eaten here?

Wing House
The victim would hang out here to watch sporting events while feasting on hot wings and celery.
What macromolecules would you expect to find in the stomach contents of the victim if the victim's final meal was eaten here?

Olive Garden
The victim loved to go here for a night of bread, olive oil, and pasta.
What macromolecules would you expect to find in the stomach contents of the victim if the victim's final meal was eaten here?

As a forensic pathologist, you have removed the contents of the victim's stomach to analyze and determine where the victim had her last meal.

Procedure:

As you are completing each test make sure you are completing the TWO charts on your lab paper.

In order to analyze the contents of the body fluid (vomit) you need to utilize the following tests:

BENEDICTS TEST (Glucose) – Beaker A:

GOGGLES MUST BE WORN FOR THE ENTIRE PERIOD.
GLOVES MUST BE WORN WHEN HANDLING CHEMICALS

1) Add a spoon full of stomach contents to 50 ml beaker.
2) Add 10 drops of BENEDICTS SOLUTION to 50 ml beaker with contents.
3) Gently stir the contents of the beaker until you see a color change.
4) Place the 50 ml beaker in the hot water bath (250 ml beaker) for 10 minutes.
5) A negative test will result in a blue color. A positive test will result in an orange color. Record the color observed.
6) WASH THE BEAKER THOROUGHLY with the brush & soap.

IODINE TEST (Starch) - Beaker B

GOGGLES MUST BE WORN FOR THE ENTIRE PERIOD.
GLOVES MUST BE WORN WHEN HANDLING CHEMICALS

1) Add a spoon full of stomach contents to beaker B.
2) Add 10 drops of IODINE SOLUTION to each beaker B.
3) Gently stir the contents of the beaker until you see a color change.
4) A negative test will result in a dark red color. A positive test will result in a black color. Record your observation.
5) WASH THE BEAKER THOROUGHLY with the brush & soap.

BIURET TEST (Protein) - Beaker C

GOGGLES MUST BE WORN FOR THE ENTIRE PERIOD.
GLOVES MUST BE WORN WHEN HANDLING CHEMICALS

1) Add a spoon full of stomach contents to test tube C
2) Add 10 drops of BIURET SOLUTION to each beaker C.
3) Gently stir the contents of the beaker until you see a color change.
4) A negative test will result in a blue color. A positive test will result in a violet/black color. Record the color observed.
5) WASH THE BEAKER THOROUGHLY with the brush & soap.

LIPID TEST- Brown Paper Bag Square

GOGGLES MUST BE WORN FOR THE ENTIRE PERIOD.
GLOVES MUST BE WORN WHEN HANDLING CHEMICALS

1) Add 3 drops of the stomach contents onto the brown paper bag square (3 inch by 3 inch).
2) Wait 3 minutes until the liquid has settled.
3) Wipe off excess vomit from brown paper bag.
4) Hold up the paper bag piece (3 inch by 3 inch) to the light and look at each spot. The foods that contain lipids will leave a greasy mark that turns the brown paper bag translucent.
5) Record your observations.
6) Dispose of the sample and brown paper bag.

The Last Supper Results

Table 1. Positive and Negative Results for the Presence of Organic Macromolecules

Macromolecule	Chemical Test	Positive Test Result	Negative Test Result
Lipids			
Proteins			
Carbohydrates—Glucose			
Carbohydrates—Starch			

Table 2._____

Test for Lipids	Test for Proteins	Test for Glucose	Test for Starch
Observations:	Observations:	Observations:	Observations:
Present? _____	Present? _____	Present? _____	Present? _____
Not Present? _____	Not Present? _____	Not Present? _____	Not Present? _____

KEY The Last Supper Results

Table 1. Positive and Negative Results for the Presence of Organic Macromolecules

Macromolecule	Chemical Test	Positive Test Result	Negative Test Result
Lipids	*Brown Bag*	*Greasy residue on bag*	*No change on bag*
Proteins	*Biuret Test*	*Color change—blue to violet = proteins present*	*No color change = no proteins present*
Carbohydrates—Glucose	*Benedict's Test*	*Color change to orange = simple sugar present*	*Color change to blue = no simple sugars present*
Carbohydrates—Starch	*Iodine Test*	*Color change to bluish-black/purple = starch present*	*No change—remains orangish brown = no starch present*

Table 2._____

Test for Lipids	Test for Proteins	Test for Glucose	Test for Starch
Observations: *Positive test result >Greasy residue on brown paper bag*	Observations: *Negative test result >No color change >remains blue*	Observations: *Negative test result >color change to (or remains) blue*	Observations: *Positive test result >Color change to bluish-black/purple*
Present? X	Present?	Present?	Present? X
Not Present?	Not Present? X	Not Present? X	Not Present?

AUTOPSY FORM

Autopsy Form completed by: Roger Mortis Date: 03-15-15

Patient's Name (Initials):	Patient's MRN:	Patient's Date of Birth:	Date Patient Expired:
Jane Doe		01-02-1990	03-14-2015

Patient's Team:	Patient's Room #:	Pronouncer's Name:	Pronounced Dead at: Date / Time
N/A	N/A	John Smith	03-14-15 / 9:45 pm

Forensic Pathologist Team Members

Was patient's death expected? ____ YES __X__ NO Was ACLS performed? ____ YES __X__ NO

DIAGNOSIS(ES): No visible signs of trauma noted on the exterior. Body fluid (vomit) was noted next to the body. Fluids sent to the lab for additional testing to help determine stomach contents.

Was family available at time of death? ____ YES __X__ NO Was autopsy discussed with family? __X__ YES ____ NO

If autopsy discussed, **was autopsy authorized**? __X__ YES ____ NO If YES, date autopsy authorized: ____

If autopsy **not discussed** or **not authorized** why not? Further testing was discussed. Forensic pathologists will conduct tests of the stomach contents to determine where the deceased ate last and if it contributed to cause of death.

Was death discussed with **FACULTY**? ____ YES ____ NO

FACULTY NAME: ____ *(Please Print)* **FACULTY SIGNATURE:** ____

NOTE: Residents, please return this form to Residency Program Administrator.

Test for Lipids	Test for Proteins	Test for Glucose	Test for Starch
Observations:	Observations:	Observations:	Observations:
Present? ____	Present? ____	Present? ____	Present? ____
Not Present? ____	Not Present? ____	Not Present? ____	Not Present? ____

Autopsy Report Answer Key

Test for Lipids	Test for Proteins	Test for Glucose	Test for Starch
Observations: ***Possible answers may include: Brown bag is translucent or greasy***	Observations: ***Possible answers may include: Solution will turn blueish***	Observations: **Possible answers may include: Solution will turn orange**	Observations: ***Possible answers may include: Solution will turn Black***
Present? ___X___	Present? _____	Present? ___X___	Present? ___X___
Not Present? _____	Not Present? ___X___	Not Present? _____	Not Present? _____

Claim/Evidence/Justification Worksheet

Guiding Question: Where did Jane Doe have her last supper?	
Claim: *(make a statement where Jane Doe ate her last meal)*	
Evidence	**Justification**
*(**put** your data, graphs, text, etc. that helps to support your claim here)*	*(**explain how** your data, graphs, text, etc helps to support your claim here)*

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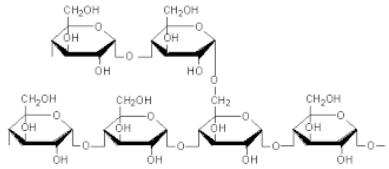
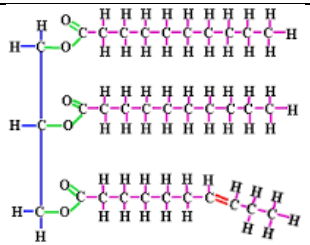
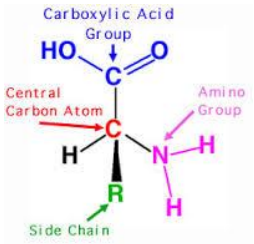
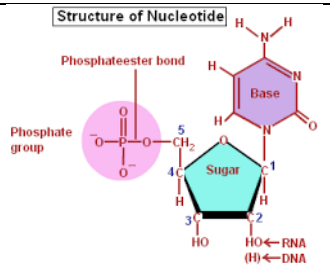
Example Claim/Evidence/Justification Worksheet

Guiding Question: Where did Jane Doe have her last supper?

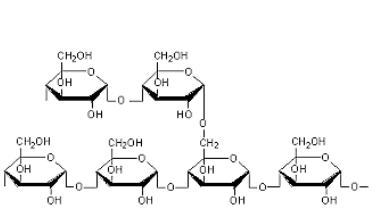
Claim: *Jane Doe ate at Olive Garden before her death.*

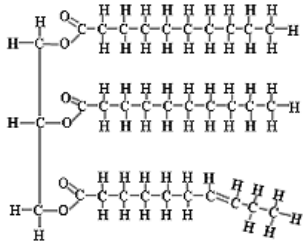
Evidence	Justification
*(**put** your data, graphs, text, etc. that helps to support your claim here)* *Students should write their final data table here and any information from the scenario that would be important to their case.*	*(**explain how** your data, graphs, text, etc helps to support your claim here)* *Answers will vary, but should explain how the presence or absence of a certain macromolecule would support their claim.*

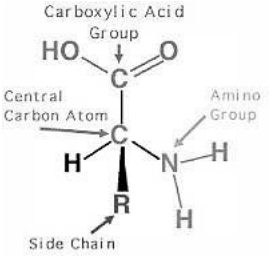
Macromolecule	Elements Ratio	Suffixes	Function	Monomer	Examples (Food)	Structure
Carbohydrates						
Lipids						
Protein						
Nucleic Acids						

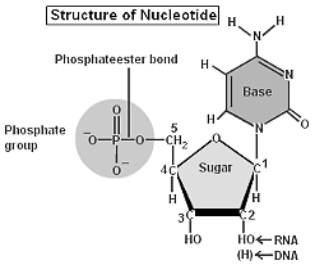
Macromolecule	Elements Ratio	Suffixes	Function	Monomer	Examples (Food)	Structure
Carbohydrates	1:2:1	OSE	- Short term energy storage - Structure (cell walls & exoskeletons)	Monosaccharide	-Glycogen -Chitin -Cellulose -Glucose fructose galactose -sucrose lactose maltose	
Lipids	No fixed ratio	Possible answers vary	- Long term energy storage - Insulates body - Cushions body organs	Triglyceride (Glycerol + 3 fatty acids)	Fats, Waxes, Oils, Steroids	
Protein	No fixed ratio	ASE	-Transports O_2 -Structural support -Enzymes -Receptors (cell membranes) - Defense	Amino Acids (20)	- Hemoglobin - Catalase - Antibodies - Keratin (hair, nails) - Actin/Myosin (muscles)	
Nucleic Acids	No fixed ratio	Possible answers vary	- Instructions for making proteins - Genetic information passed from parent to offspring	Nucleotide (5-C sugar + phosphate + nitrogen base)	DNA RNA	

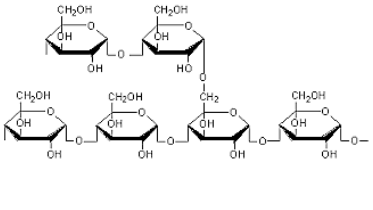
Macromolecules Structure Cut-Outs

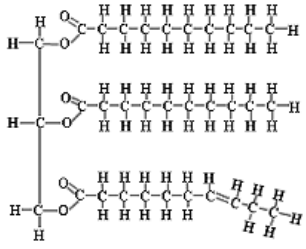


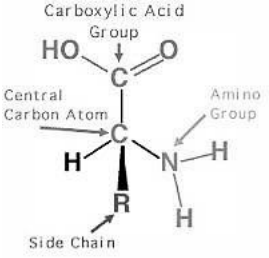


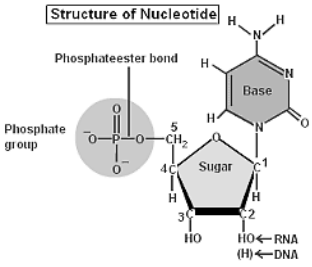












Fan and Pick Scenario Cards

Animals like whales and seals have a thick layer of blubber, fatty tissue, under their skin. How would these animals be better adapted to colder environments where food sources are limited?

Describe a dinner a marathon runner would eat the night before running the Boston Marathon, and give reasons for your food choices.

What advice would you give someone who asked you "what foods should I eat to increase my nucleic acid intake?"

Proteins carry out several different functions in the body. What about protein's structure allows it to be so versatile?

Where do we get most of the building blocks for our macromolecules?

You are competing in a 50-day survival challenge and can choose only one type of food to bring. What food do you choose and why: lard, meat, or bread?

Fan and Pick Scenario Cards Answer Key

1. Describe a dinner a marathon runner would eat the night before running the Boston Marathon, and give reasons for your food choices. The dinner should include many forms of carbohydrates and some proteins (for examples pasta and meat) The carbohydrates provide and energy source and proteins help to build and repair muscles.

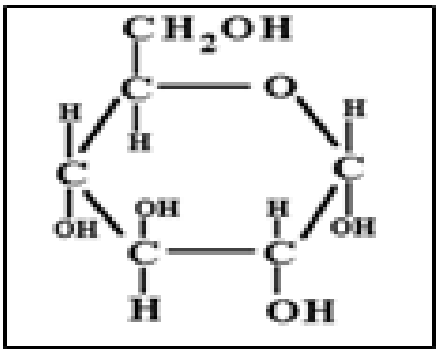
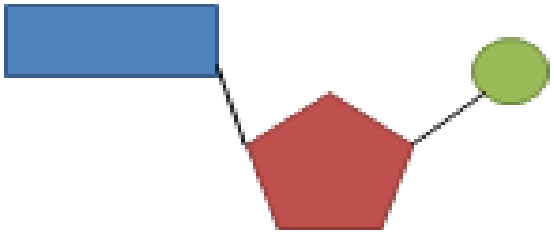
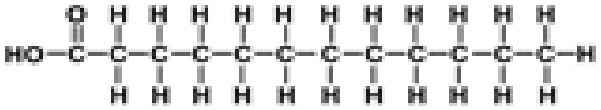
2. Animals like whales and seals have a thick layer of blubber, fatty tissue, under their skin. How would these animals be better adapted to colder environments where food sources are limited? Fat is long-term energy storage; the blubber can supply the animal with energy when they don't eat for a long period of time.

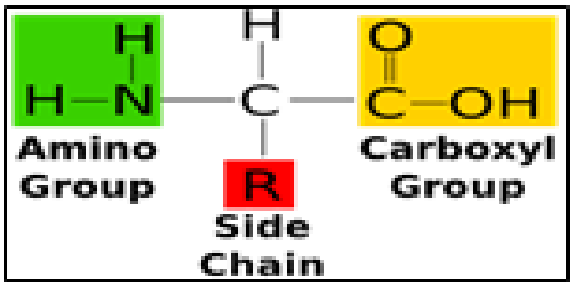
3. What advice would you give someone who asked you "what foods should I eat to increase my nucleic acid intake? All living things contain nucleic acids, so they can just eat more of any once living food source.

4. **Proteins carry out several different functions in the body. What about protein's structure allows it to be so versatile?** The R group in the protein structure is interchangeable. A different R group is used based on the protein's function.

5. Where do we get most of the building blocks for our macromolecules? We receive most of our building blocks from the food we eat.

6. You are competing in a 50-day survival challenge and can choose only one type of food to bring. What food do you choose and why: lard, meat, or bread? Lard; the lipid would supply you with the long term energy you would need to survive the 50-day challenge.

carbohydrate	What macromolecule is represented by this picture? 
Nucleic acid	What macromolecule is represented by this picture? 
lipid	What macromolecule is represented by this picture? 

protein	**What macromolecule is represented by this picture?** 
carbohydrates	**What macromolecule is found mostly found in Fruits and Breads?**
lipid	**What macromolecule is mostly found in butter and oil?**

protein	What macromolecule is found in meats?
Nudeic acid	What macromolecule makes up DNA and RNA?
saccharide	What is the monomer of a carbohydrate?

nudeotide	What is the monomer of a nucleic acid?
Amino acid	What is the monomer of a protein?
Fatty acids and glycerol (triglyceride)	What is the monomer of a lipid?

The single molecule that makes up a polymer; a building block	What is a monomer?
A large molecule consisting of many repeating sub-units (polymer).	What is a polymer?
monomer	One Lego in a lego house would represent a _____ in a macromolecule.

polymer	The entire Legohouse would represent a _____ in a macromolecule.
carbohydrate	If an athlete were going to run a race, which macromolecule would be best for providing energy?
lipid	This macromolecule stores energy and makes up the cell membrane:

A – protein B - phosphoLIPID	The cell membrane is made of which two macromolecules?
Nucleic acid	What macromolecule stores and transfers genetic information?
protein	What type of macromolecule are most enzymes?

protein	Which macromoleculewould be helpful in repairing musde?
lipid	Most mammals (ex. Polar bear) that live in cold weather have a layer of fat to maintain body temperature, which macromoleculemabes up this fat?
lipid	Many plants have waxy coatings on some surfaces. This coating reduces water loss because it is not water-soluble. This waxy coating is which type of macromolecule?

protein	**Which macromolecule provides structure for hair, skin and nails?**
lipid	**Lemur's bodies are adapted to store energy for times when food is scarce. Which macromolecule is primarily used for long-term energy storage in the lemur?**
Molecule 3	**Which of the molecules in this table is a carbohydrate?** Molecule | Composition | Function 1 | amino acids | reaction catalyst 2 | fatty acids | membrane component 3 | monosaccharides | energy source 4 | nucleotides | genetic information

Molecule 1	**Which of the molecules in this table is a protein?** Molecule | Composition | Function 1 | amino acids | reaction catalyst 2 | fatty acids | membrane component 3 | monosaccharides | energy source 4 | nucleotides | genetic information
carbon, hydrogen, oxygen and nitrogen	**Plants and animals are composed of organic compounds. List the 4 most common elements found in organic compounds.**
macromolecule	**Each small organic molecule can be a unit of a large organic molecule, and this is called a:**

Macromolecule Check for Understanding →

Name:_____

1. A biologist was given a sample of an unknown organic macromolecule and asked to determine the class of organic macromolecules to which it belonged. The chart shown below represents the results of the biologist's analysis of the sample. Based on these results, to which class of organic macromolecules did this sample belong? *(SC.912.L.18.1)*

a. lipid
b. protein
c. nucleic acid
d. carbohydrate

Element	Number of Atoms per molecule
C	6
H	12
O	6
K	0
N	0
P	0

2. Proteins do all of the following things in the body, except which of the following? *(SC.912.L.18.1)*
   a. digest food
   b. carry genetic information
   c. carry oxygen in the blood
   d. speed up chemical reactions

3. Leon has a big football game this evening. What macromolecule should he load up on during dinner to ensure that he has enough energy for the big game? *(SC.912.L.18.1)*
   a. carbohydrate
   b. protein
   c. nucleic acid
   d. lipid

4. Storing energy is the primary function of two macromolecules. What macromolecule is represented by the structure below? *(SC.912.L.18.1)*
   a. carbohydrate
   b. protein
   c. nucleic acid
   d. lipid

5. If Jennifer wanted to grow her hair out without fear of it breaking or becoming damaged, what macromolecule should she increase in her daily diet? *(SC.912.L.18.1)*
   a. protein
   b. lipid
   c. nucleic acid
   d. carbohydrate

6. You are working with compound in a laboratory. You figure out the structure and see that it is made up of carbon, hydrogen, and oxygen in a ratio of two hydrogen atoms for each carbon atom. How could you best classify this compound? *(SC.912.N.1.1, SC.912.L.18.1)*
   a. lipid
   b. protein
   c. carbohydrate
   d. nucleic acid

Macromolecule Check for Understanding →
Name:_____

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b. proteins
c. nucleic acids
d. lipids

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a. lipid
b.protein
c. carbohydrate
d. nucleic acid