Macromolecule Manipulative Review

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Grade- 10

Lesson Duration- This activity is versatile; it can be a quick 10 minute review or a longer 30 minute activity.

Materials Needed- Macromolecule manipulative sheets, attached. Scissors.

Background Information

There are four groups of compounds that are found in all living things. These four groups are called Macromolecules or Biomolecules. These two words can be used interchangeably. Macro = big, so the word literally means "big molecules". They are made of smaller units called monomers. Monomers join together to form polymers. Mono = one Poly = many

Carbohydrates are molecules made of a monomer called monoscaccharides. Monosaccharides can join to form disaccharides (di-two) or polysaccharides. Carbohydrates serve 3 functions: 1. Primary energy storage 2. Provide structure 3. Cellular communication. Examples of carbohydrates include sugars & starches like glucose, cellulose, glycogen, ribose, sucrose. Many carbohydrate names end with “ose”.

Proteins are molecules made of a monomer called amino acids. Examples of amino acids: serine, tryptophan, leucine. There are 20 different standard amino acids found in nature. Amino acids are made of a carbon atom with an amino group, carboxyl group, and R group, which determine which amino acid is made. Proteins serve several different functions in the cell including: controlling reactions (enzymes), regulating cellular processes (insulin), forming (actin & myosin), transporting molecules (protein channels, hemoglobin), and fighting disease (antibodies).

Lipids are made from the monomer fatty acid. Fatty acids are hydrophobic, which means they don't mix with water. Lipids serve many functions in the cell including: secondary energy storage, boundaries, steroids, waterproofing. Examples of lipids include: fats, oils, waxes, testosterone, cholesterol, cell membrane

Nucleic acids are made of nucleotides. Nucleotides are a monomer made from a sugar, phosphate group, and a nitrogenous base. The primary function of nucleic acids is the carry the genetic code, but ATP, the molecule that serves as the currency for energy in the cell is also a nucleic acid. Examples of nucleic acids are DNA, RNA, and ATP.

There are laboratory tests that can be used to determine the presences of these macromolecules. These tests and their results are:
Benedict's test for glucose (or reducing sugar): positive result - red/orange
Iodine test for starch, also called Lugol's test: positive result - black
Brown paper bag test for lipids: positive result –clear
Biuret's test for protein: positive result - purple

Lesson Objective

Students will be able distinguish between proteins, carbohydrates, lipids, and nucleic acids. Students will be able to recognize images of the 4 groups listed above. Students will be able to identify positive tests for the macromolecules.

Instructional Process

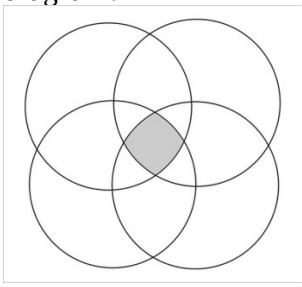
This activity should follow instruction on the 4 groups of macromolecules. Teacher should print the attached macromolecule manipulative sheets. A student aid can cut out the words and pictures in advance and place them in a small ziploc baggie. Print everything on cardstock to make it last. Students can work independently, in pairs, or in groups. Each needs 1 manipulative grid and a 1 baggie of words and pictures.

Students should be instructed to arrange the words and pictures on the grid to match them to the appropriate macromolecule.

After students have had time to arrange the words and pictures, teacher can show the answer key on the board for students to check their work.

Assessment/Follow-up

Create a Venn diagram to compare and contrast the 4 groups of macromolecules. Draw a large 4 part Venn diagram.



Label each circle with one of the 4 macromolecules.
Fill in the diagram with as much information as possible.
The locations where the circles overlap should be filled with information that the macromolecules have in common.

Key Vocabulary

Macromolecule, biomolecule, monomer, polymer, carbohydrate, monosaccharide, polysaccharide, disaccharide, protein, amino acid, lipid, fatty acid, nucleic acid, nucleotide, Biuret reagent, Benedict's test, Lugol's test

Safety and Cleanup Required

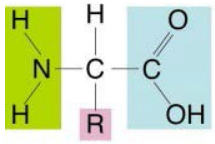
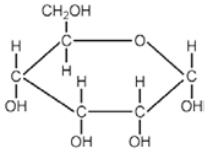
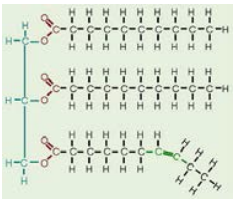
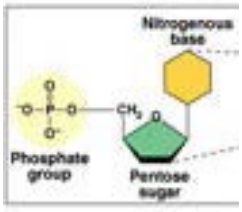
If materials are printed on cardstock, they can be saved and used by classes year to year. Each set of words and pictures should be collected into a plastic baggie for storage.

Alignment with TN Science and Math Standards-

CLE 3210.1.2 Distinguish among the structure and function of the four major organic macromolecules found in living things.
✓3210.1.3 Design a graphic organizer that compares proteins, carbohydrates, lipids, and nucleic acids. SPI 3210.1.3 Distinguish among proteins, carbohydrates, lipids, and nucleic acids.
SPI 3210.1.4 Identify positive tests for carbohydrates, lipids, and proteins.

Carbohydrates	Proteins
Lipids	**Nucleic Acids**

Monosaccharide	Main energy storage	Provide structure
Sugars	Starch	Glucose
Most names end in “ose”	Ribose	Positive Color: Red
Amino Acid	Indicator: Brown Paper Bag	Indicator: Sudan III
Control reactions	Transport molecules	Regulate cell processes
Form bones & muscles	Fight Disease	Enzymes
Hemoglobin	Insulin	Antibodies
Fatty acid	Steroids	Secondary energy storage
Boundaries	Waterproofing	Fats
Oils	Waxes	Positive Test: Black
Cell Membrane	Hydrophobic	Positive Test: Purple
Nucleotide	Indicator: Benedict’s	Indicator: Biuret
Carry the genetic code	DNA	RNA
Positive Test: Red/Orange	Positive Test: Clear	Indicator: Iodine

Answer Key

Carbohydrates

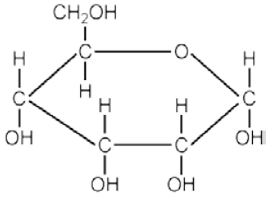
Monosaccharide

Sugars Ribose Glucose Starch

Main Energy Storage

Provide Structure

Most Names end in “ose”



Indicator: Benedict

Positive Test: Red/Orange

Indicator: Iodine

Positive Test: Black

Proteins

Amino Acids Control Reactions

Transport Molecules

Regulate Cell processes

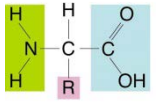
Form bones & muscles Enzymes

Fight Disease

Insulin Hemoglobin Antibodies

Indicator: Biuret’s

Positive Test: Purple



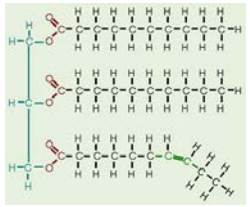
Lipids

Fatty acid Boundaries

Oil Steroids Fats Waterproofing

Waxes Secondary energy storage

Cell Membrane Hydrophobic



Indicator: Brown Bag

Positive Test: Clear

Nucleic Acids

Nucleotide Carry the genetic code

DNA RNA