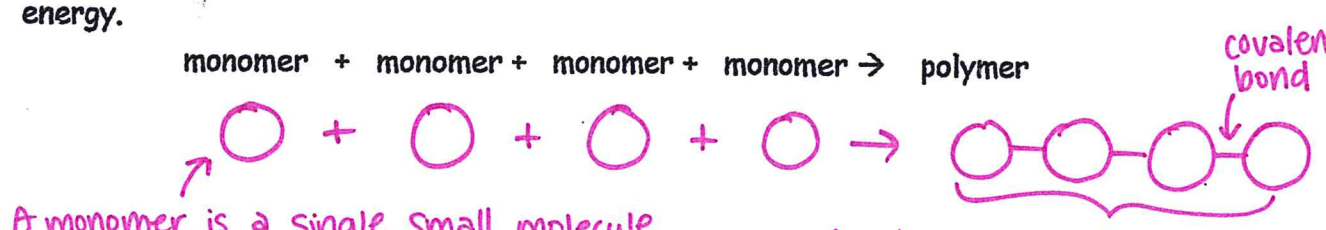
"MACROMOLECULES" AND THEIR MONOMERS

↳ large biological molecules built from smaller organic molecules

Life is created by small building blocks (monomers) which make up larger molecules (polymers) which make up an organism. Life is sustained by breaking some of these larger molecules down for energy.

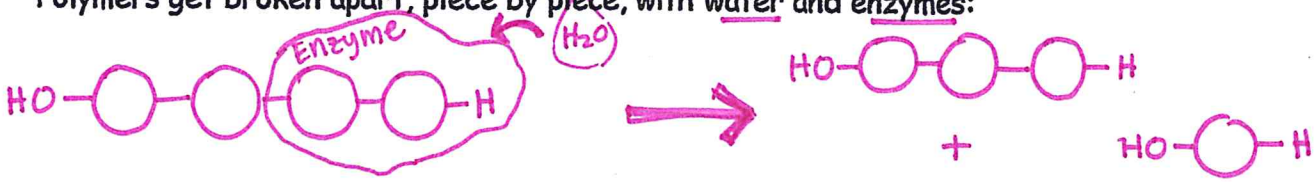
monomer + monomer + monomer + monomer → polymer



A monomer is a single small molecule

A polymer is a chain of monomers.

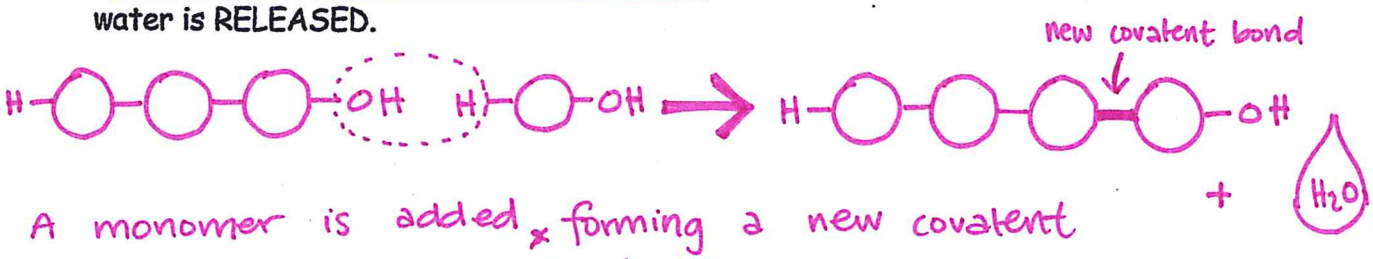
Polymers get broken apart, piece by piece, with water and enzymes:



Energy is stored in the bonds of molecules: it takes energy to create them, so it makes sense that energy would be released when they come apart.

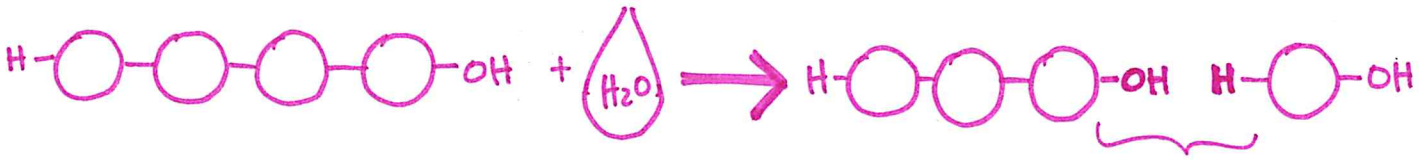
The 2 specific reactions that create and break down polymers are controlled by enzymes.

a. Dehydration synthesis/condensation reactions: Monomers are joined together, a molecule of water is RELEASED.



A monomer is added, forming a new covalent bond. water is released.

b. Hydrolysis: Monomers are separated from the polymer by chemically ADDING a molecule of water. Hydrolysis means "to break with water".



water was added to break the polymer

The 4 groups of macromolecules are: (NOT in order of importance)

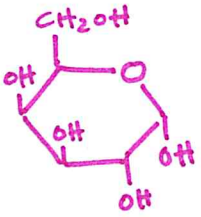
a) Carbohydrates – made of sugars
b) Lipids – made of fatty acids (& glycerol)
c) Proteins – made of amino acids
d) Nucleic acids – made of nucleotides (& sugar & phosphate)

These provide matter and energy to all living things, and it's why we eat!

twice as much hydrogen

carbon → ← oxygen

1. CARBOHYDRATES: Contain only the elements C, H, O in a 1:2:1 ratio.



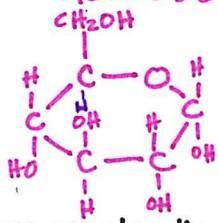
Monomers: Simple sugars, or monosaccharides.

All have the chemical formula $C_6H_{12}O_6$, but have different shapes.

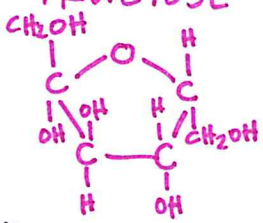
ISOMERS – same formula, different structure

a. glucose – made by all green plants
b. fructose – fruit sugar
c. galactose – milk sugar

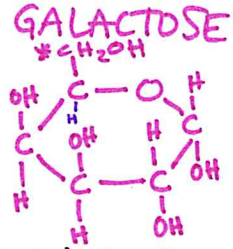
GLUCOSE



FRUCTOSE



GALACTOSE



abbreviation shows everything but C & H groups

There are also disaccharides (two monomers: sucrose, maltose, lactose)

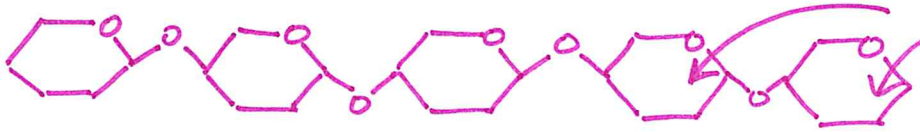
sucrose = glucose + fructose maltose = glucose + glucose lactose = galactose + glucose

Polysaccharides make the MACROMOLECULES. (Poly = many) They are:

polymers made from glucose

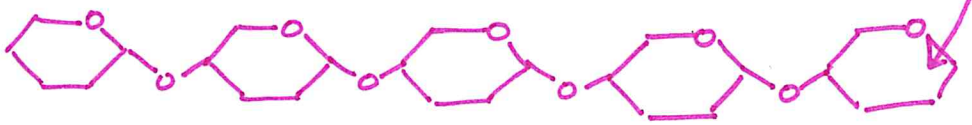
a. Cellulose – in plants only. Structural component of cell walls and wood. Give plants structure. Humans can't digest this.
b. Starch – in plants only, serve as long term energy storage. Humans can digest this.
c. Glycogen- made in animals only. Used as emergency energy supply, stored in liver and muscles. It can easily be broken into simple sugars if needed.
d. Chitin- found in mushrooms and insect exoskeletons. Humans can digest this.

CELLULOSE

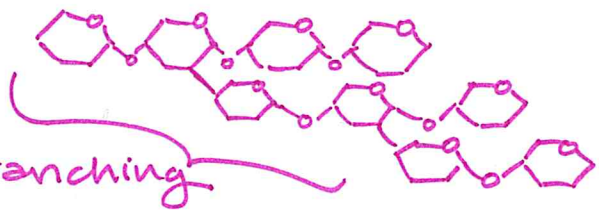


glucose sugars

STARCH

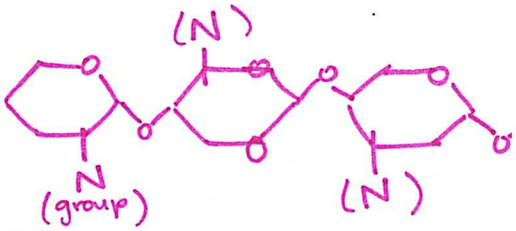


GLYCOGEN



branching

CHITIN



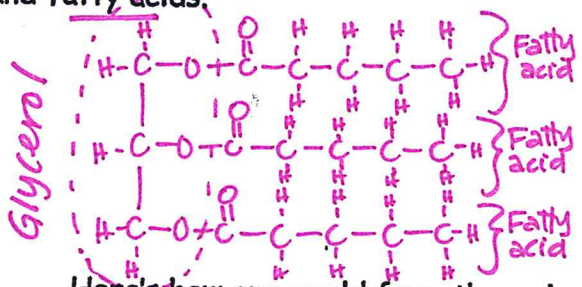
2. LIPIDS : Contain only the elements C,H,O as well, but the ratio is different.

Lipids can be waxy or oily, and are usually nonpolar. The function of lipids is:

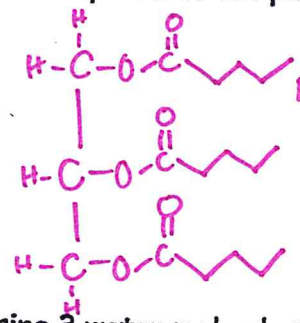
a. to provide long term energy storage and "insulation"
b. to make up cell membranes
c. to act as chemical messengers

↖ trap heat to stay warm

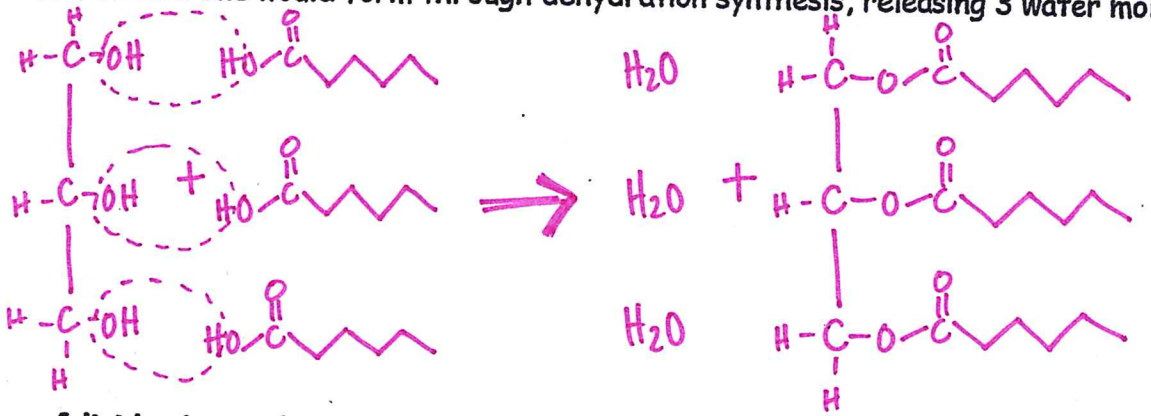
A triglyceride, a common lipid, doesn't have legit monomers, but is composed of two parts, glycerol and fatty acids.



This molecule can be written like this →

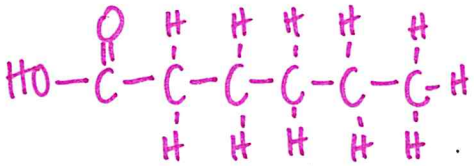


Here's how one would form through dehydration synthesis, releasing 3 water molecules:



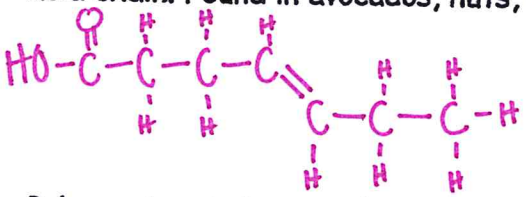
Types of lipids: Dependent on the bonds between atoms on the fatty acid chains:

a. Saturated: all single bonds between carbon and hydrogen. Solid at room temp. Mostly in meats and dairy products.



also written like this →

b. Unsaturated: one double bond between 2 carbon atoms, resulting in fewer H atoms in the fatty acid chain. Found in avocados, nuts, and some cooking oils.



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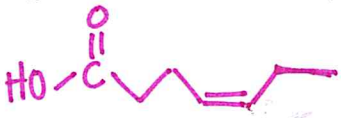
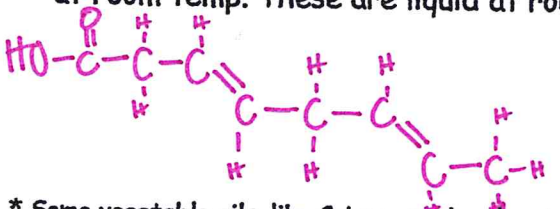


c. Polyunsaturated: more than one double bond between carbon atoms on the fatty acid chain. Liquid at room temp. These are liquid at room temperature, like canola or safflower oil.



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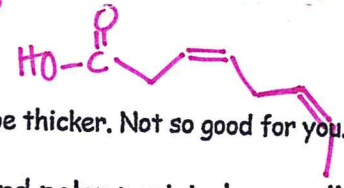
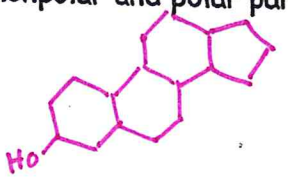


* Some vegetable oils, like Crisco, can be chemically "hydrogenated" to be thicker. Not so good for you.

d. phospholipids: make up cell membranes. Have a nonpolar and polar part to keep cells separate from each other.

e. sterols: chemical messengers for cells



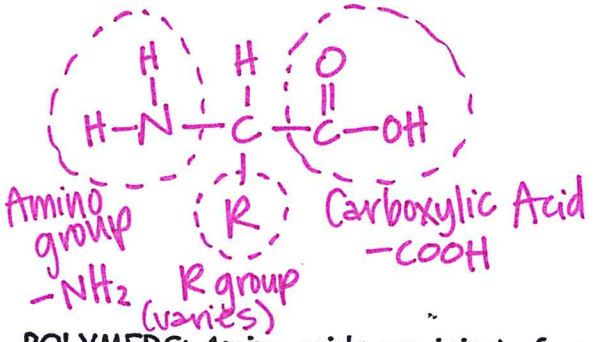
3. PROTEINS: Contain C, H, O, N.

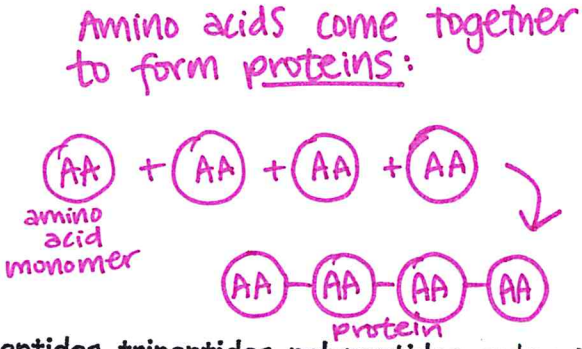
: Most structures in living things are made from proteins. (Hair, muscles, cartilage)

: They are used to pump things in and out of cells

: Enzymes are made of protein, and enzymes control chemical reactions.

MONOMER: amino acids. There are 20 different amino acids. They all have identical structures, except for one part, the "R" group. "R" is an organic side chain that is different for each of the 20 amino acids. Here is a generic structure:





POLYMERS: Amino acids can join to form dipeptides, tripeptides, polypeptides, and proteins. They can have simple or complex shapes. More details soon ☺

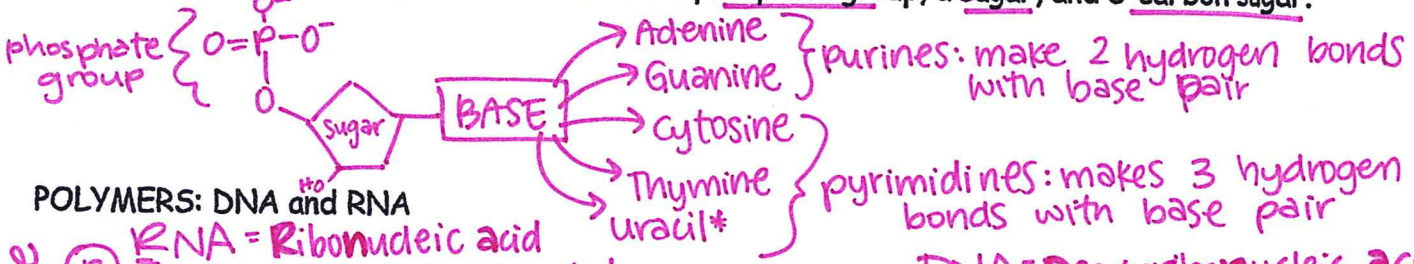
4. NUCLEIC ACIDS: Contain C, H, N, O, P, and S.

These: Guanine (G), Cytosine (C), Thymine (T), Uracil (U), Adenine (A)

a. Store and transmit genetic information

b. Provide the recipe for proteins.

MONOMERS: nucleotides, A T G C. Each has a phosphate group, a sugar, and 5-carbon sugar.



POLYMERS: DNA and RNA