

Unit 2: 1B Basic Biochemistry Concept Development

YOU ARE WHAT YOU EAT!

You've heard this saying hundreds of times before, but have you every really thought about it? The saying holds a great deal of truth. Everything that you eat contains molecules which your body uses in order to create energy or build structures. Do you know what these molecules are? Today you are going to be investigating the biological molecules that you need in order to survive. You and your partners will put on the hats of architects as you build biomolecules in order to learn about their structure and function. This activity is designed to help you master the expectations of 1B of the Mastery Rubric.

CARBOHYDRATES

Materials:

6- Carbon Atoms

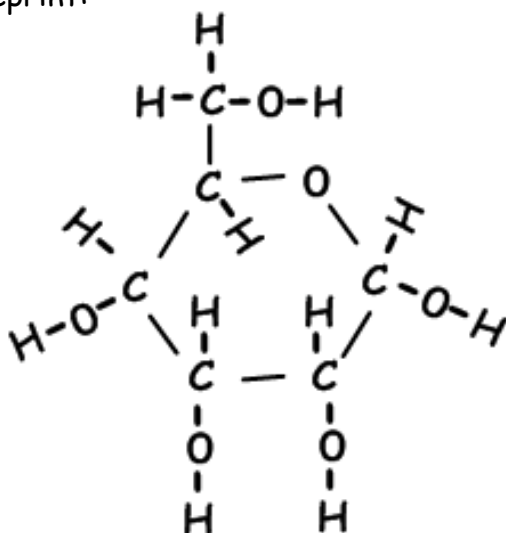
6- Oxygen Atoms

12- Hydrogen Atoms

23- covalent bonds

After gathering your materials, you will begin construction of a particular Carbohydrate. Use your book, other resources, and your individual intelligence in order to create the very important simple sugar, *Glucose*. After constructing glucose, answer the questions listed below on this sheet.

Your Blueprint:



Single lines represent a single covalent bond.

Double lines represent double bonds.

Glucose forms a ring when placed in water.

1. The molecule you have just built is a type of carbohydrate. What is the function of carbohydrates in your body?

2. Compare and contrast the following terms:
 - monosaccharide vs. disaccharide vs. polysaccharide

 - simple carbohydrate vs. complex carbohydrate

Collaboration time! With the help of at least the 2 lab tables closest to you, can you build a polysaccharide? HINT.....You need to use all 3 of your glucose models and you need to know what role **DEHYDRATION SYNTHESIS** plays in this process.

- What molecule do you produce when linking two monosaccharides together?

- Do you know what the macromolecule you have just formed is called? After naming this molecule, discuss how its function differs from the function of glucose in the space below. Do the structures of glucose and your new molecule complement their functions? If yes, explain why in the space below.

- What if you wanted to break your polysaccharide apart? What molecule do you need to have present in order to break apart monosaccharides which are linked together? What is this process called?

LIPIDS

Materials:

6- Carbon Atoms

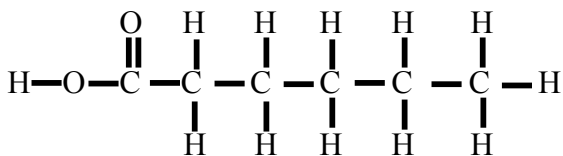
2- Oxygen Atoms

12- Hydrogen Atoms

19- Covalent Bonds

After gathering your materials, you will begin construction of a saturated fatty acid. Using your book, other resources, and your own intelligence complete the construction of the fatty acid. Finally, use your model and other resources in order to complete the questions listed below.

Your Blueprint:



Single lines again represent a single covalent bond.

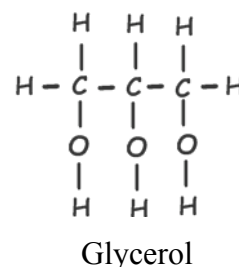
Double lines represent a double bond.

What is a Carboxyl group? Can you circle an example on your blueprint?

1. What is the difference between a saturated fatty acid and an unsaturated fatty acid? Can you draw an unsaturated fatty acid in the space below? Hint.....there's only one difference between the unsaturated fatty acid and your blueprint above! (Your book can help with this!!)

2. What function do fats serve in the human body? Why are fats referred to as Lipids?

Collaboration Time! Using the fatty acid that you have just constructed and the fatty acids from two other lab groups, can you form a triglyceride (also known as triacylglycerol)? Hint.....You'll need to build a new molecule called glycerol and you'll end up with 3 water molecules when your done. See page 57 in your book if you're still stumped! Sketch a "skeleton" diagram here:



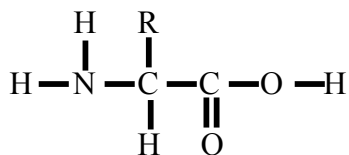
- What process helped you combine three fatty acids to glycerol? What molecule was also produced besides the triglyceride?
- Explain the difference in function between fatty acids and triglycerides. Do the structures of fatty acids and triglycerides complement their different functions? Explain how in the space below.
- What molecule will you need in order to breakdown your triglyceride into glycerol and three fatty acids? What is this process referred to as?

PROTEINS

Materials:

- 1- Nitrogen Atom
- 2- Carbon Atoms
- 1- Functional Group (Also known as an R Group)
- 2- Oxygen Atoms
- 3- Hydrogen Atoms
- 9- Covalent Bonds

Your Blueprint:



Single lines represent single covalent bonds.

Double lines represent double bonds.

There are 20 different functional groups. Thus, there are twenty different amino acids. The structure of all 20 amino acids is identical except for the functional group. The Functional group is abbreviated as R in this activity. See the attached sheet for the various different R groups!!

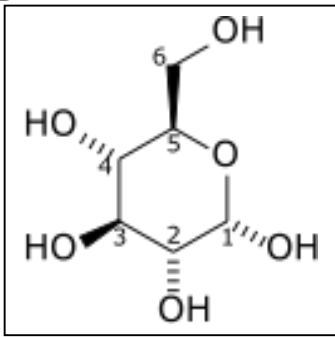
After gathering your materials, construct an amino acid. Use your book, other resources, and your own intelligence to help you construct the molecule. After constructing your amino acid, use the model and other resources to answer the questions listed below.

1. You have just constructed an amino acid. What is the difference between an amino acid and a protein? Explain in the space below.

Collaboration Time! Using your own amino acid and at least two other groups' amino acids, build a protein. Hint.....view page 58 in your book to help construct your new protein. You'll end up with water again!

2. What process did you need in order to turn two or more amino acids into a protein?
3. What is the bond which holds two amino acids together called? Draw a protein two amino acids in length and circle the bond which holds the amino acids together.
4. What is a polypeptide? Would a protein be considered a polypeptide?
5. What function do proteins serve in the body?
6. If you wanted to break your protein down into individual amino acids, what molecule would you need to have present? What is this process referred to as?

ABBREVIATIONS



SCIENTISTS HAVE A HABIT OF ABBREVIATING THE STRUCTURES OF CERTAIN MOLECULES. FOR EXAMPLE, THIS IS GLUCOSE. ANSWER THE QUESTIONS WHICH FOLLOW ABOUT THIS ABBREVIATED STRUCTURE.

1. The points of the diagram labeled 1,2,3,4,5, and 6 all represent which atom?
2. What atoms are not even shown in the diagram? Hint..... there are seven of this atom missing from the diagram!!
3. Bond lines between what two atoms have not been drawn in this abbreviated diagram?

SYNTHESIS TIME!

Compare and Contrast Carbohydrates (Glycogen in particular), Fats (triglycerides), and Proteins for the following categories:

	CARBOHYDRATES	FATS	PROTEINS
STRUCTURE			
FUNCTION IN THE BODY			
SOURCE (WHERE DO THEY COME FROM?)			
BUILDING BLOCKS (monomers)			

Structures of Amino Acids

R = any number carbons in a hydrocarbon chain

*CHIME plug-in required to view these images.

Amino Acid Name	A b r e v.	A b r e v.	Structure of R group (red)	Comments
Alanine	ala	A	$\begin{array}{c} \text{H} \quad \text{O} \\ \quad \\ \text{H}_3\text{N}^+ - \text{C} - \text{C} - \text{O}^- \\ \\ \text{CH}_3 \end{array}$	Neutral Non-polar
Arginine	arg	R	$\begin{array}{c} \text{H} \quad \text{O} \\ \quad \\ \text{H}_3\text{N}^+ - \text{C} - \text{C} - \text{O}^- \\ \\ (\text{CH}_2)_3 - \text{N}^+ - \text{C} - \text{NH}_2 \\ \\ \text{H} \end{array}$	Basic Polar
Asparagine	asn	N	$\begin{array}{c} \text{H} \quad \text{O} \\ \quad \\ \text{H}_3\text{N}^+ - \text{C} - \text{C} - \text{O}^- \\ \\ \text{CH}_2 - \text{C} - \text{NH}_2 \\ \\ \text{O} \end{array}$	Neutral Polar
Aspartic Acid	asp	D	$\begin{array}{c} \text{H} \quad \text{O} \\ \quad \\ \text{H}_3\text{N}^+ - \text{C} - \text{C} - \text{O}^- \\ \\ \text{CH}_2 - \text{C} - \text{OH} \\ \\ \text{O} \end{array}$	Acidic Polar
Cysteine	cys	C	$\begin{array}{c} \text{H} \quad \text{O} \\ \quad \\ \text{H}_3\text{N}^+ - \text{C} - \text{C} - \text{O}^- \\ \\ \text{CH}_2 - \text{SH} \end{array}$	Neutral Slightly Polar
Glutamic Acid	glu	E	$\begin{array}{c} \text{H} \quad \text{O} \\ \quad \\ \text{H}_3\text{N}^+ - \text{C} - \text{C} - \text{O}^- \\ \\ \text{CH}_2\text{CH}_2 - \text{C} - \text{OH} \\ \\ \text{O} \end{array}$	Acidic Polar
Glutamine	gln	Q	$\begin{array}{c} \text{H} \quad \text{O} \\ \quad \\ \text{H}_3\text{N}^+ - \text{C} - \text{C} - \text{O}^- \\ \\ \text{CH}_2\text{CH}_2 - \text{C} - \text{NH}_2 \\ \\ \text{O} \end{array}$	Neutral Polar
Glycine	gly	G	$\begin{array}{c} \text{H} \quad \text{O} \\ \quad \\ \text{H}_3\text{N}^+ - \text{C} - \text{C} - \text{O}^- \\ \\ \text{H} \end{array}$	Neutral Non-polar
Histidine	his	H	$\begin{array}{c} \text{H} \quad \text{O} \\ \quad \\ \text{H}_3\text{N}^+ - \text{C} - \text{C} - \text{O}^- \\ \\ \text{CH}_2 - \text{C}_5\text{H}_4\text{N}_2^+ \end{array}$	Basic Polar

Isoleucine	ile	I	$ \begin{array}{c} \text{H} \quad \text{O} \\ \quad \\ \text{H}_3\text{N}^+ - \text{C} - \text{C} - \text{O}^- \\ \\ \text{H}_3\text{C} - \text{CH} - \text{CH}_2 - \text{CH}_3 \end{array} $	Neutral Non-polar
Leucine	leu	L	$ \begin{array}{c} \text{H} \quad \text{O} \\ \quad \\ \text{H}_3\text{N}^+ - \text{C} - \text{C} - \text{O}^- \\ \\ \text{CH}_2 - \text{CH} - \text{CH}_3 \\ \\ \text{CH}_3 \end{array} $	Neutral Non-polar
Lysine	lys	K	$ \begin{array}{c} \text{H} \quad \text{O} \\ \quad \\ \text{H}_3\text{N}^+ - \text{C} - \text{C} - \text{O}^- \\ \\ \text{CH}_2(\text{CH}_2)_3 - \text{NH}_2 \end{array} $	Basic Polar
Methionine	met	M	$ \begin{array}{c} \text{H} \quad \text{O} \\ \quad \\ \text{H}_3\text{N}^+ - \text{C} - \text{C} - \text{O}^- \\ \\ \text{CH}_2\text{CH}_2 - \text{S} - \text{CH}_3 \end{array} $	Neutral Non-polar
Phenylalanine	phe	F	$ \begin{array}{c} \text{H} \quad \text{O} \\ \quad \\ \text{H}_3\text{N}^+ - \text{C} - \text{C} - \text{O}^- \\ \\ \text{CH}_2 - \text{C}_6\text{H}_5 \end{array} $	Neutral Non-polar
Proline	pro	P	$ \begin{array}{c} \text{O} \\ \\ \text{HC} - \text{C} - \text{O}^- \\ \\ \text{H}_2\text{N}^+ \end{array} $	Neutral Non-polar
Serine	ser	S	$ \begin{array}{c} \text{H} \quad \text{O} \\ \quad \\ \text{H}_3\text{N}^+ - \text{C} - \text{C} - \text{O}^- \\ \\ \text{CH}_2 - \text{OH} \end{array} $	Neutral Polar
Threonine	thr	T	$ \begin{array}{c} \text{H} \quad \text{O} \\ \quad \\ \text{H}_3\text{N}^+ - \text{C} - \text{C} - \text{O}^- \\ \\ \text{HO} - \text{CH} - \text{CH}_3 \end{array} $	Neutral Polar
Tryptophan	trp	W	$ \begin{array}{c} \text{H} \quad \text{O} \\ \quad \\ \text{H}_3\text{N}^+ - \text{C} - \text{C} - \text{O}^- \\ \\ \text{CH}_2 - \text{C}_8\text{H}_6\text{N}_2 \end{array} $	Neutral Slightly polar
Tyrosine	tyr	Y	$ \begin{array}{c} \text{H} \quad \text{O} \\ \quad \\ \text{H}_3\text{N}^+ - \text{C} - \text{C} - \text{O}^- \\ \\ \text{CH}_2 - \text{C}_6\text{H}_4 - \text{OH} \end{array} $	Neutral Polar