

# Biomolecules

# Question

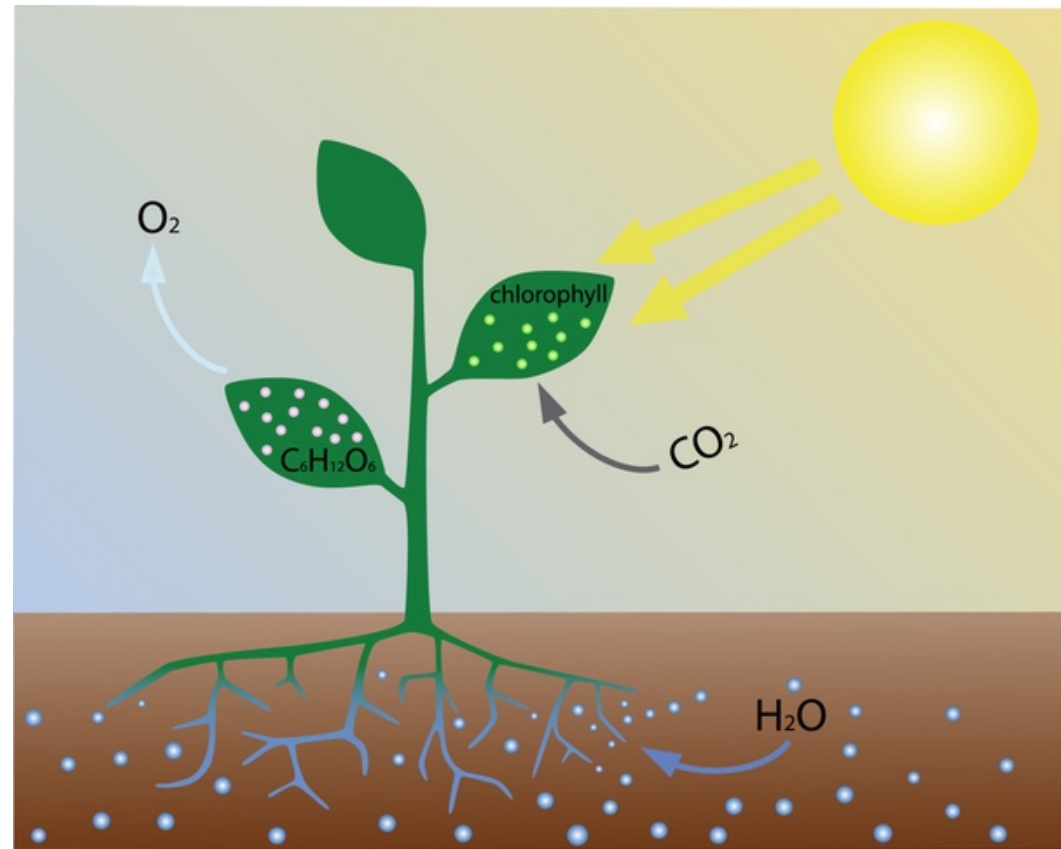
- All organisms are made out of four types of biomolecules, what are they?

# 4 Biomolecules

1. Carbohydrates
2. Proteins
3. Lipids
4. Nucleic Acids

# Photosynthesis

- Plants break the  $\text{H}_2\text{O}$  and  $\text{CO}_2$  to make new molecules.
- $6 \text{H}_2\text{O} + 6 \text{CO}_2$  get rearranged into  $\text{C}_6\text{H}_{12}\text{O}_6 + 6 \text{O}_2$

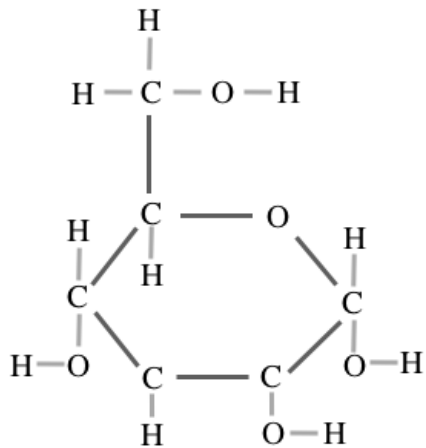


# Question

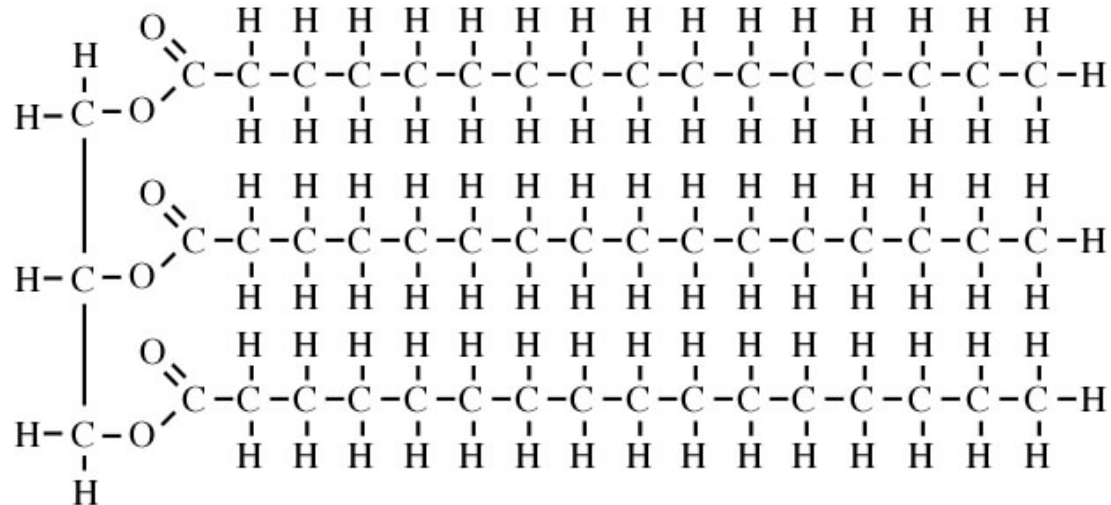
- If plants perform photosynthesis to make the carbohydrate glucose, then where does the other biomolecules come from?

# Make New Biomolecules

- Plants and animals can make new molecules by rearranging the C, H, O atoms in glucose.
- For example, if you take **many** glucose molecules, you can make a lipid molecule (**triglyceride = fat**).



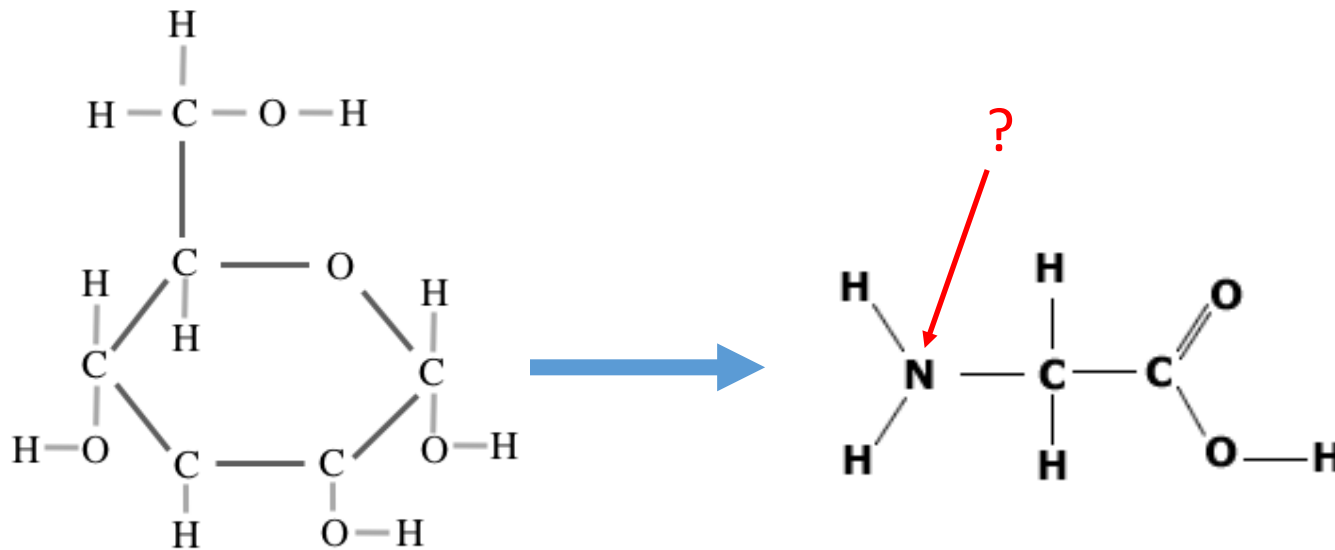
Carbohydrate  
(Glucose)



Lipid  
(Triglyceride)

# Question

- How can a carbohydrate make a protein, when the protein has a new atom like nitrogen?

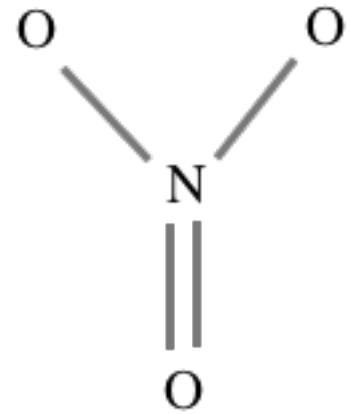


Carbohydrate  
(Glucose)

Protein  
(amino acid)

# Minerals - Nitrogen

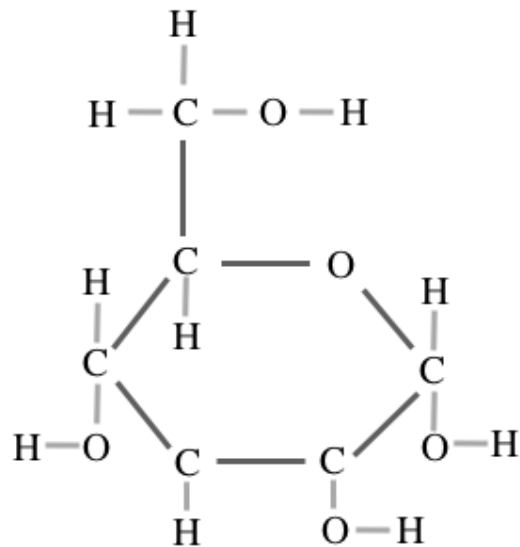
- An important mineral an organism needs is nitrate (contains nitrogen atom).
- Nitrates are an important part of fertilizer for plants.



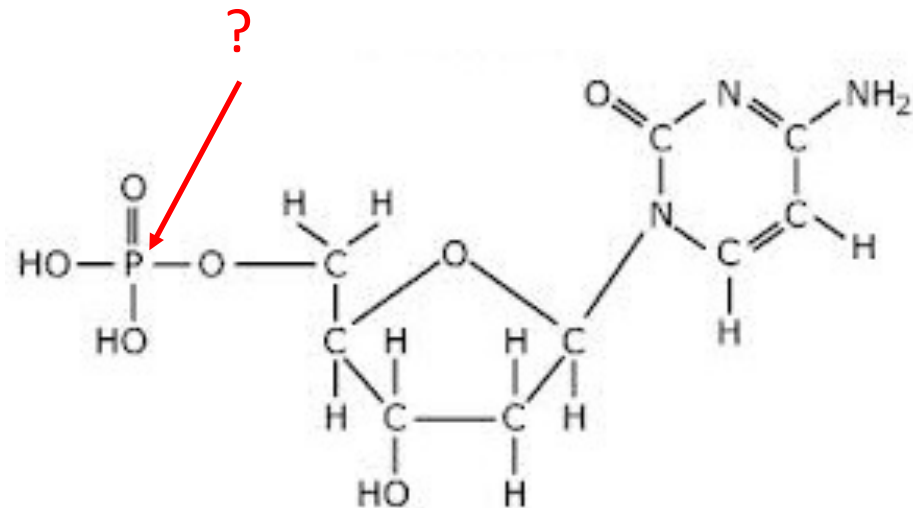


# Question

- How can a carbohydrate make a nucleic acid (DNA) molecule, when DNA has a new atom like phosphorus?



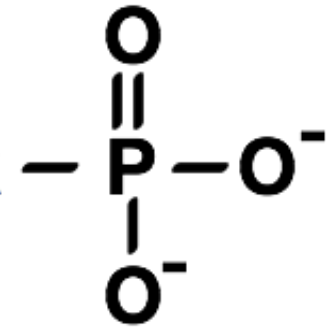
Carbohydrate  
(Glucose)



Nucleic Acid  
(DNA)

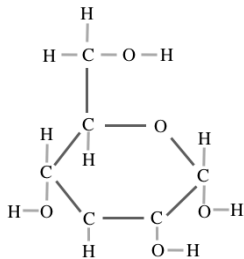
# Minerals - Phosphorus

- Another important mineral an organism needs is phosphate (contain phosphorus atom).
- Phosphates are an important part of fertilizer for plants.

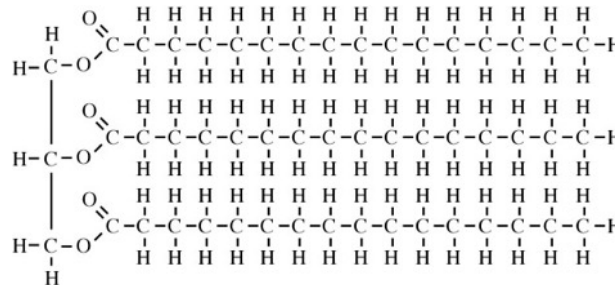


# Change Biomolecules

- One biomolecule, like carbohydrates, can be used to make another biomolecule.
- This is done by using the carbon, hydrogen, and oxygen (CHO) atoms in carbohydrates and rearranging those atoms to form a new biomolecule.



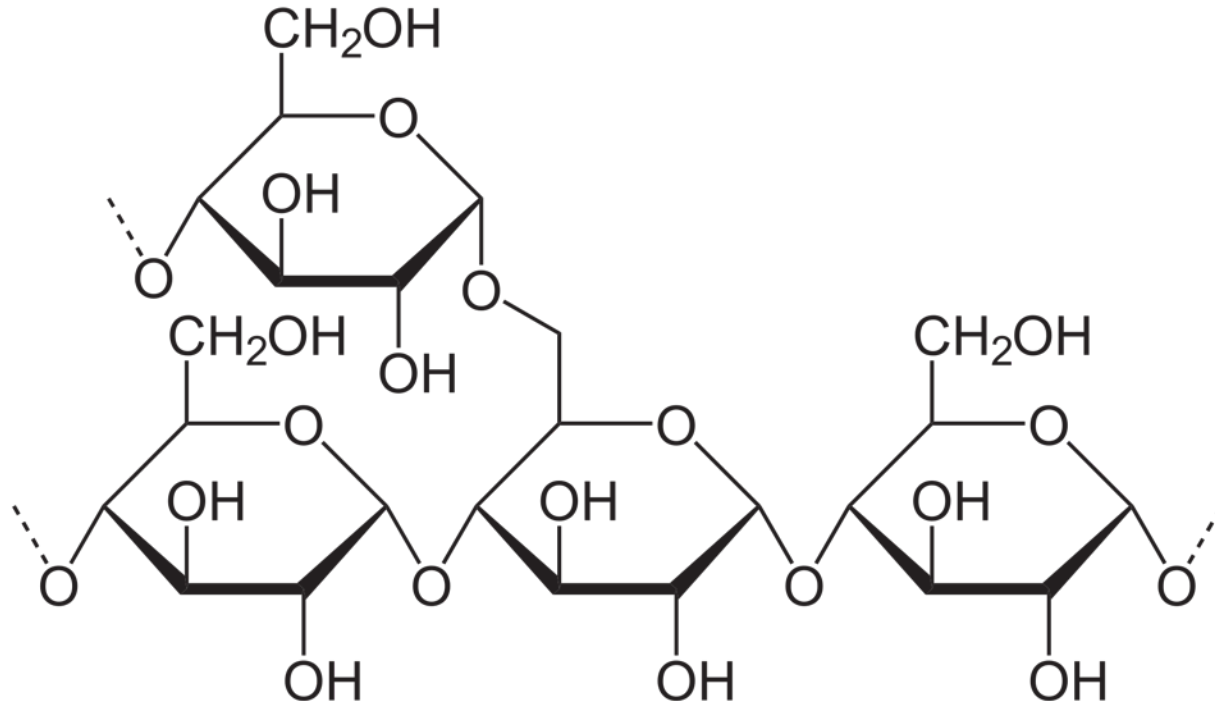
Carbohydrate  
(Glucose)



Lipid  
(Triglyceride)

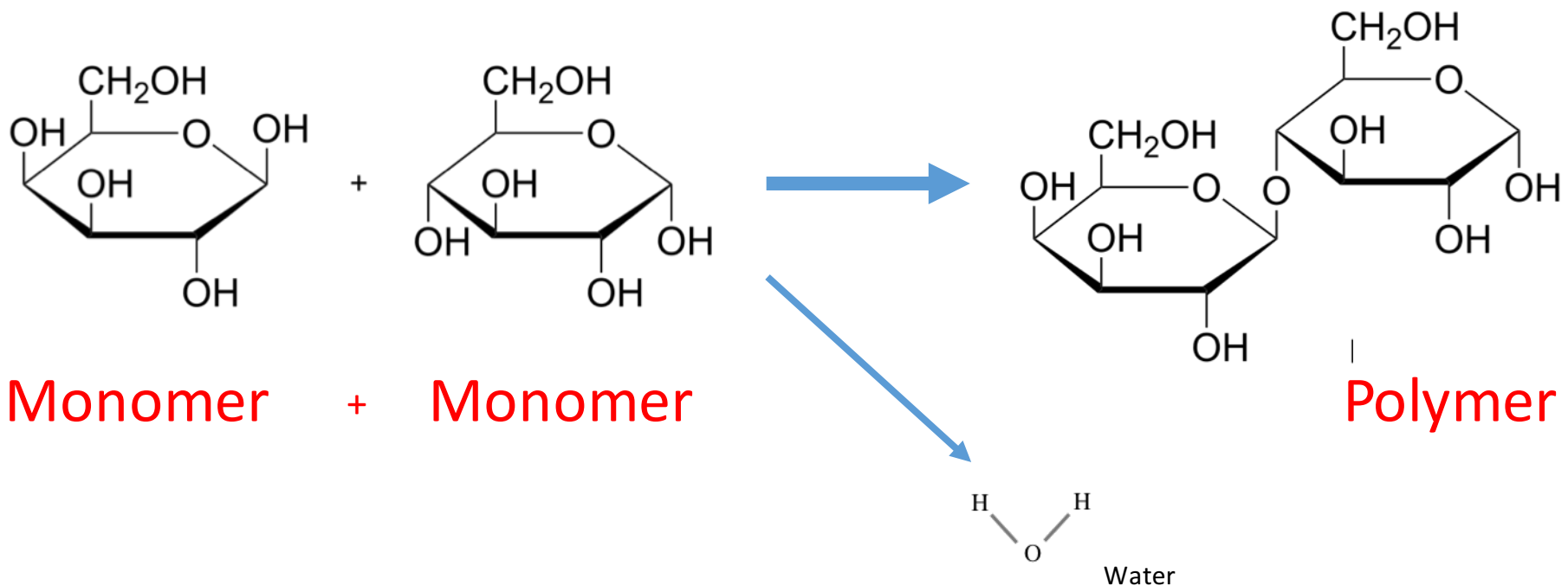
# Building Block Molecules

- Larger macromolecules called polymers are made out of smaller molecules called monomers.
- Notice the monomers are repeating in the diagram below.



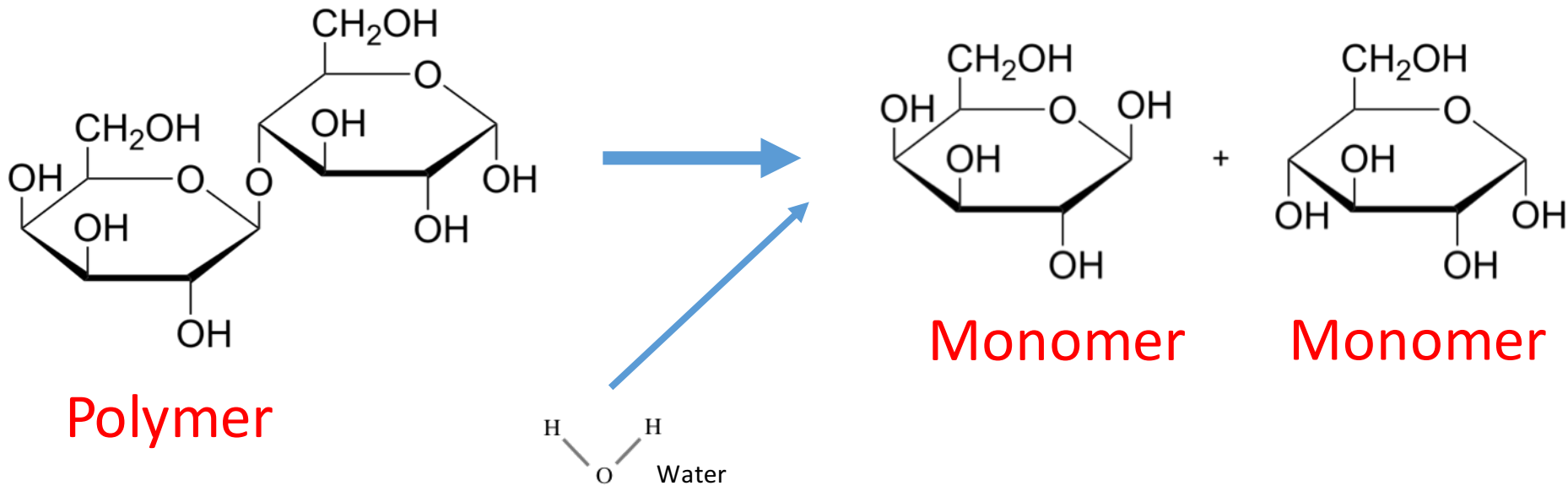
# Building Polymers (Dehydration Synthesis)

- For example, if you combine two simple sugar monomers, you can make a larger polymer.



# Breaking Polymers (Hydrolysis)

- The chemical reaction can go in the opposite direction.
- You can break a larger polymer into their monomers.

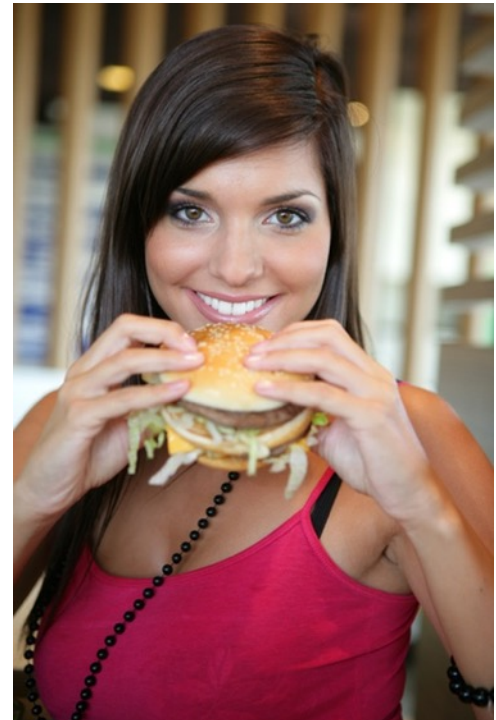


# Monomers and Polymers

Macromolecule	Monomer	Polymer
Carbohydrate	Monosaccharide (glucose)	Polysaccharide (starch)
Protein	Amino acid	Protein (enzymes)
Lipid	Fatty Acids	Fats, Oils, Membranes (phospholipids, triglycerides)
Nucleic Acids	Nucleotide	DNA or RNA

# You Are What You Eat

- The macromolecules in your food break down (digestion) into monomers and your body will use those monomers to make new macromolecules.





# Metabolism

- Metabolism is just a chemical reaction in the cell, like:
  - Photosynthesis
  - Cellular Respiration
  - Making Polymers (dehydration synthesis)
  - Breaking Polymers (hydrolysis)
- These chemical reactions are helped by enzymes.
  - Enzymes help to perform metabolism by reducing the amount of energy needed to start the chemical reaction.