Macromolecules

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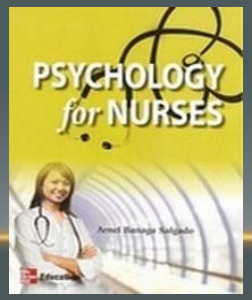
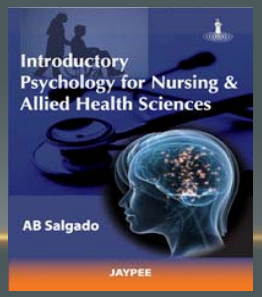
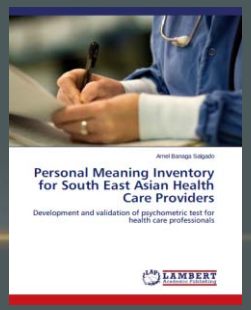


McGraw-Hill





MACROmolecules

The Big Four

WHY ARE MACROMOLECULES IMPORTANT TO THE HUMAN BODY?

Macromolecules are essential to the functioning of the human body.

- ✓ Carbohydrates are the body's main source of energy.
- ✓ Lipids provide stored energy reserves. This allows us to survive when carbohydrates are not being supplied to the body.
- ✓ Protein helps us stay strong, by forming new bones and muscles, and helping us fight diseases.
- ✓ Nucleic acids are responsible for making each person functional and unique; they are the blueprint for our genetic structure.

WHAT IS OUR TASK?

Learn the Basic Structure and Function of:

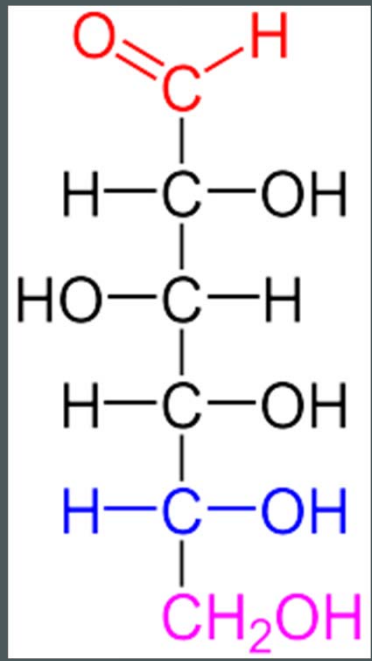
- Carbohydrates
- Lipids
- Protein
- Nucleic Acids

…And Learn The Role of Enzyme Catalysts!

CARBOHYDRATES ARE THE MAIN ENERGY SOURCE OF THE BODY!

- Carbohydrates are formed of **carbon**, **hydrogen**, and **oxygen** atoms with a **ratio of 1:2:1**.

- The two categories of carbohydrates include **sugar** and **starch**.



Glucose is an example of a simple sugar.

CARBOHYDRATES ARE COMPOSED OF **SACCHARIDES**

The smallest unit of saccharides is a monosaccharide.
("Mono" = one)

Monosaccharides are also referred to as
Simple Sugars

Monosaccharides combine together to form disaccharides
("Di" = two)

Examples:

Lactose & Sucrose

Monosaccharides can also form larger carbohydrates such as:

- Oligosaccharides are chains of 3-10 monosaccharides. (“Oligo” = few)
- Polysaccharides are the largest unit of carbohydrates (“Poly” = many)

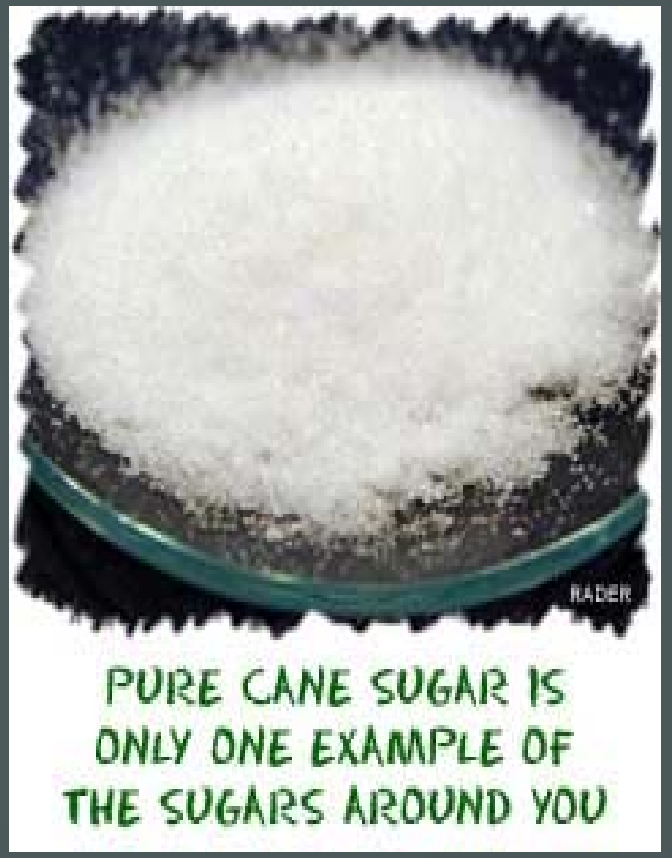
Polysaccharides are referred to as complex carbohydrates

Starches are polysaccharide chains made from 300 - 1000 glucose units

CARBOHYDRATE BREAKDOWN

- Enzymes in the mouth, stomach, and small intestine, breakdown the carbohydrate molecules.

- These large complex carbohydrate molecules breakdown into simple sugars.



How Does The Breakdown Occur?

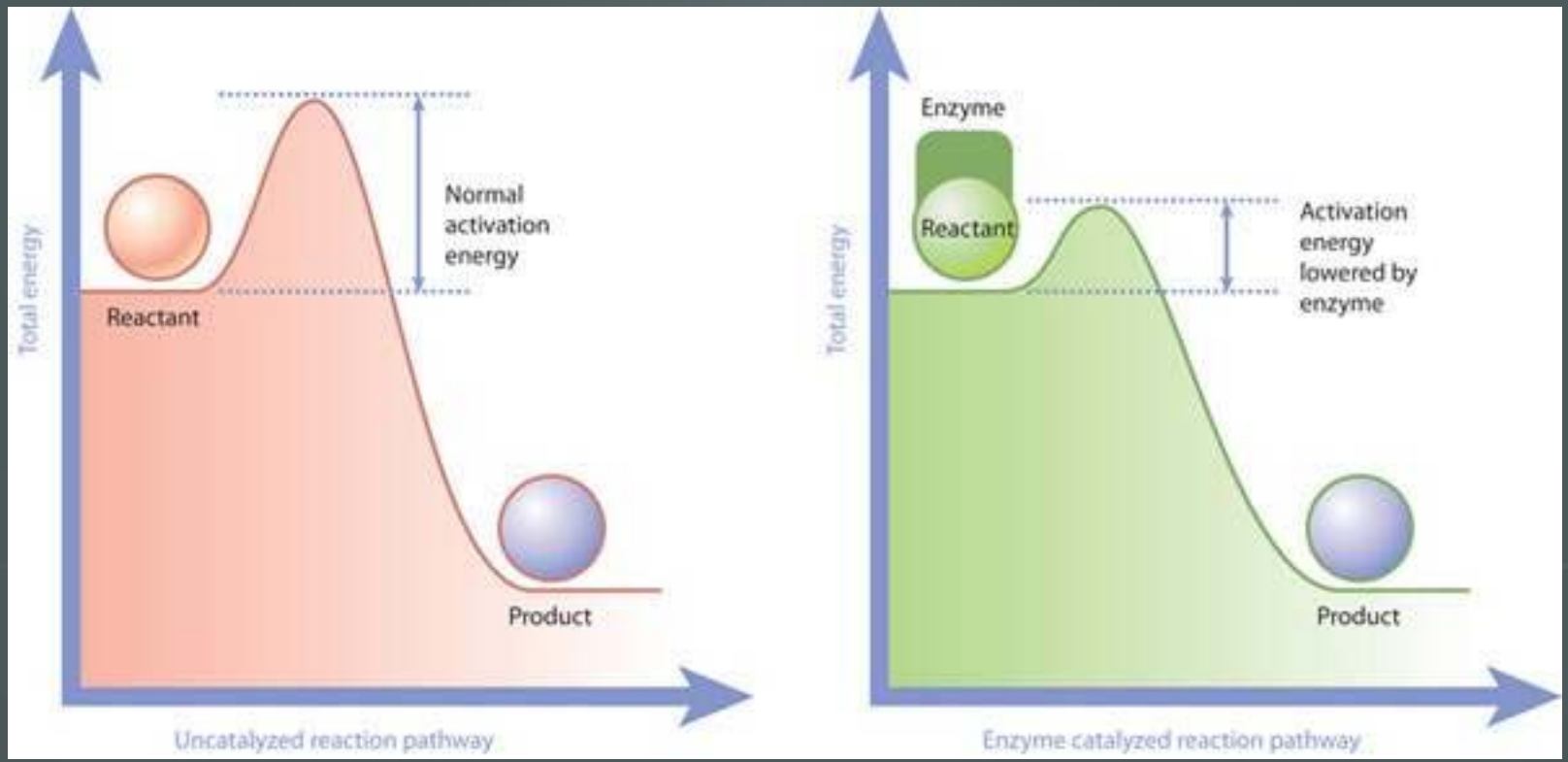
Our bodies use special protein molecules called enzymes to break the larger molecules into smaller pieces.

Enzymes Are Catalysts

[Catalysts are chemicals that quicken a chemical reaction without undergoing any change themselves]

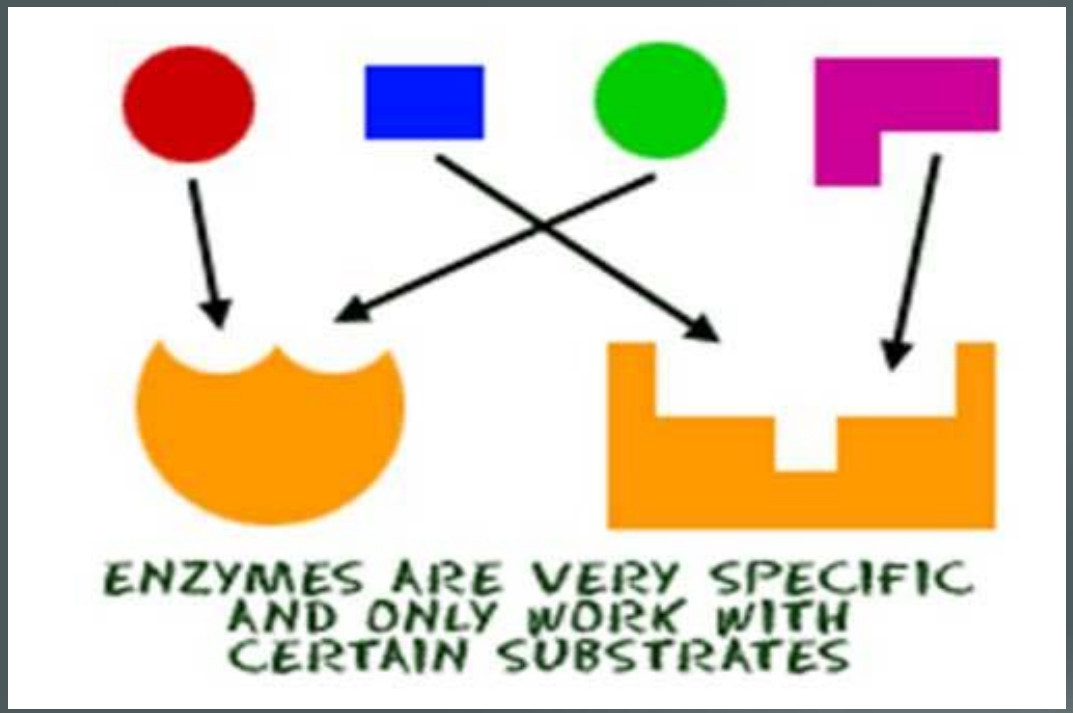
THE ROLE OF ENZYMES

- Activation Energy is the energy needed to start a reaction.
- An enzyme is a protein catalyst that speeds up biological reactions by lowering the activation energy!
- Some life processes are too slow when they occur on their own,
  but enzymes help speed them up!



THE ROLE OF ENZYMES

- Each enzyme is very **specific** and only attaches to one type of molecule.
- The molecule the enzyme acts upon is called its **substrate**.



Variables that impact enzyme activity:

1. Temperature

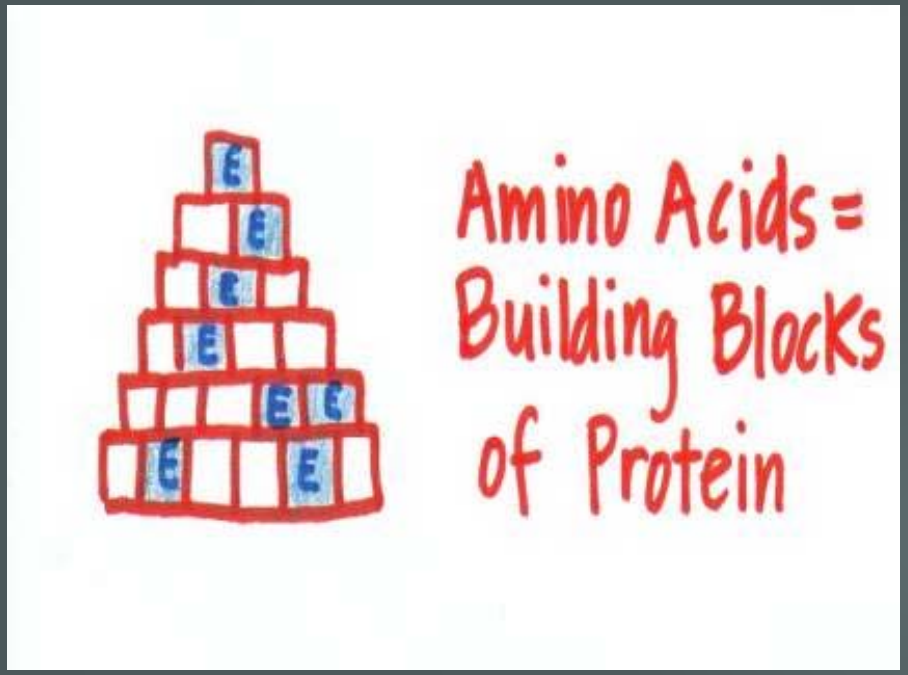
2. pH

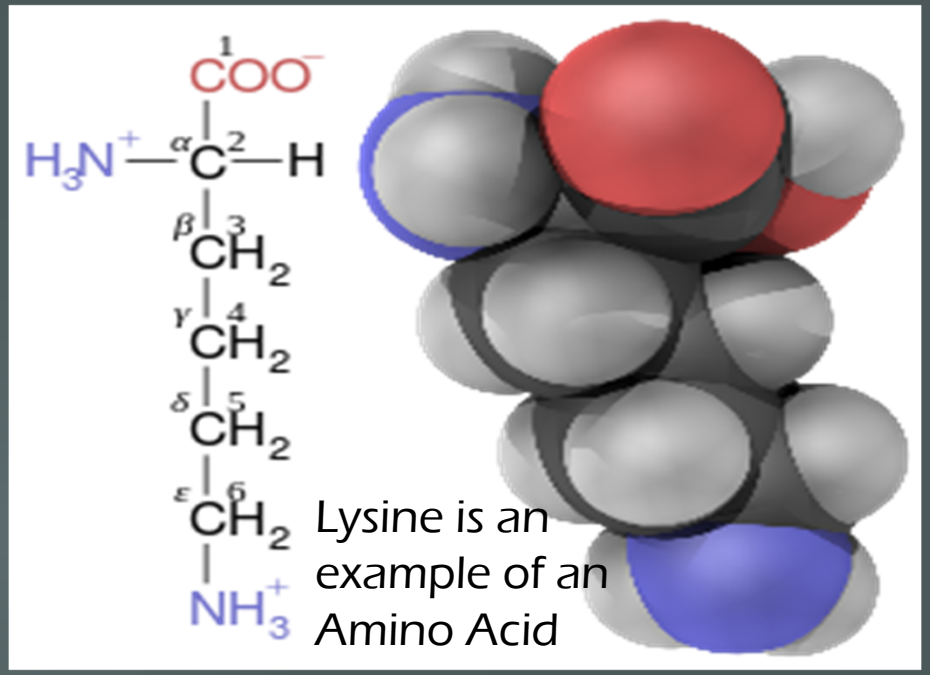
PROTEIN

Proteins are nutrients which contain materials the body uses for **growth and repair**.

- Proteins are made of **Carbon**, **Hydrogen**, **Oxygen** and **Nitrogen**.
- Proteins are large molecules made up of combinations of **amino acids**.

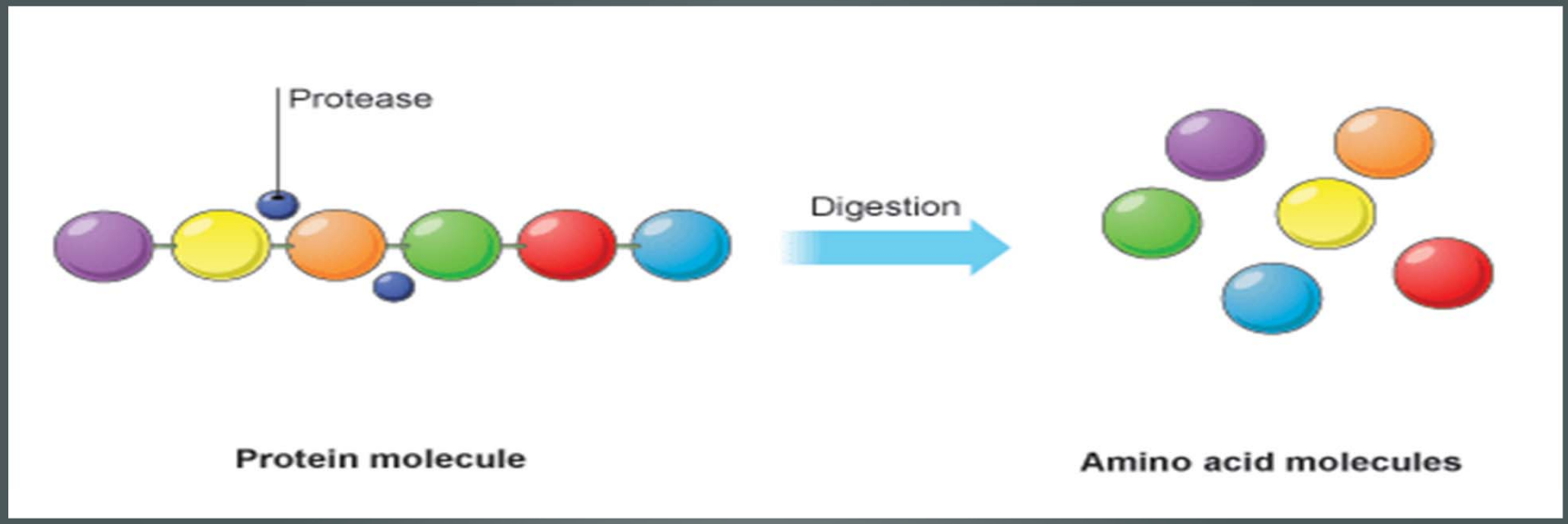
AMINO ACIDS → PEPTIDES → POLYPEPTIDES → PROTEIN





- **Amino acids** are the building blocks of proteins.
- These building blocks bond together to form chains that are called **peptides**.
- Proteins are formed of combinations of large peptides chains, this is referred to as **polypeptides**.

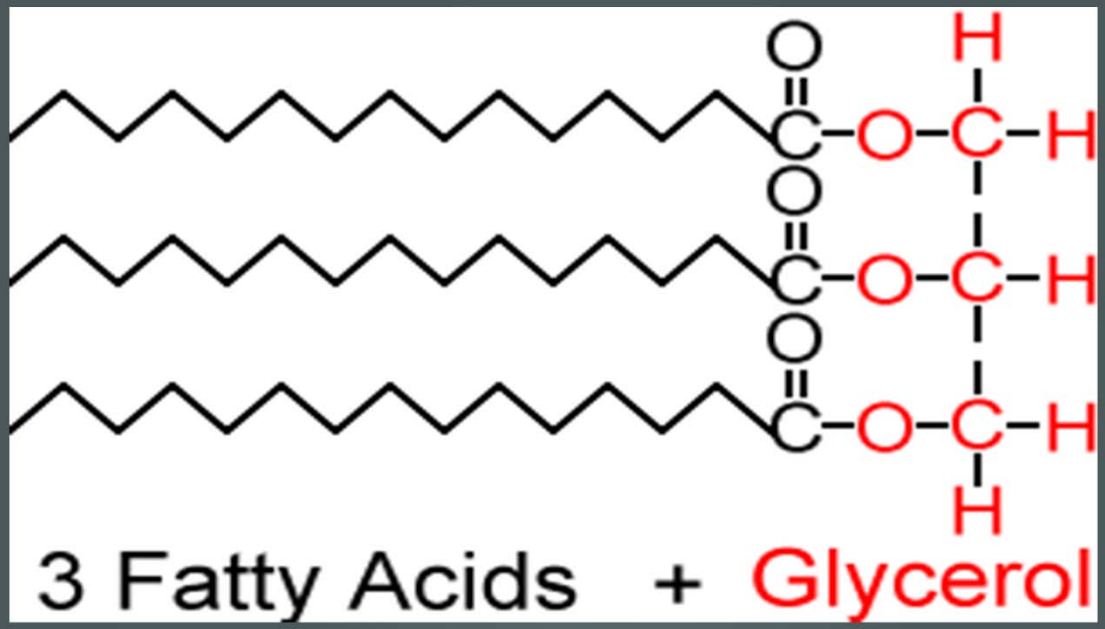
In order for the body to use protein, enzymes in the stomach and small intestine break the polypeptides down into individual amino acids.



LIPIDS

- **Lipids** function as **stored energy**, **insulation for the body**, **and** **assist absorption of certain vitamins**.
- Lipids are large molecules that can be categorized as **fats** **or** **oils**.
- Lipids are composed of **triglycerides.**
- These molecules are made up of **carbon**, **hydrogen**, and **oxygen** atoms.

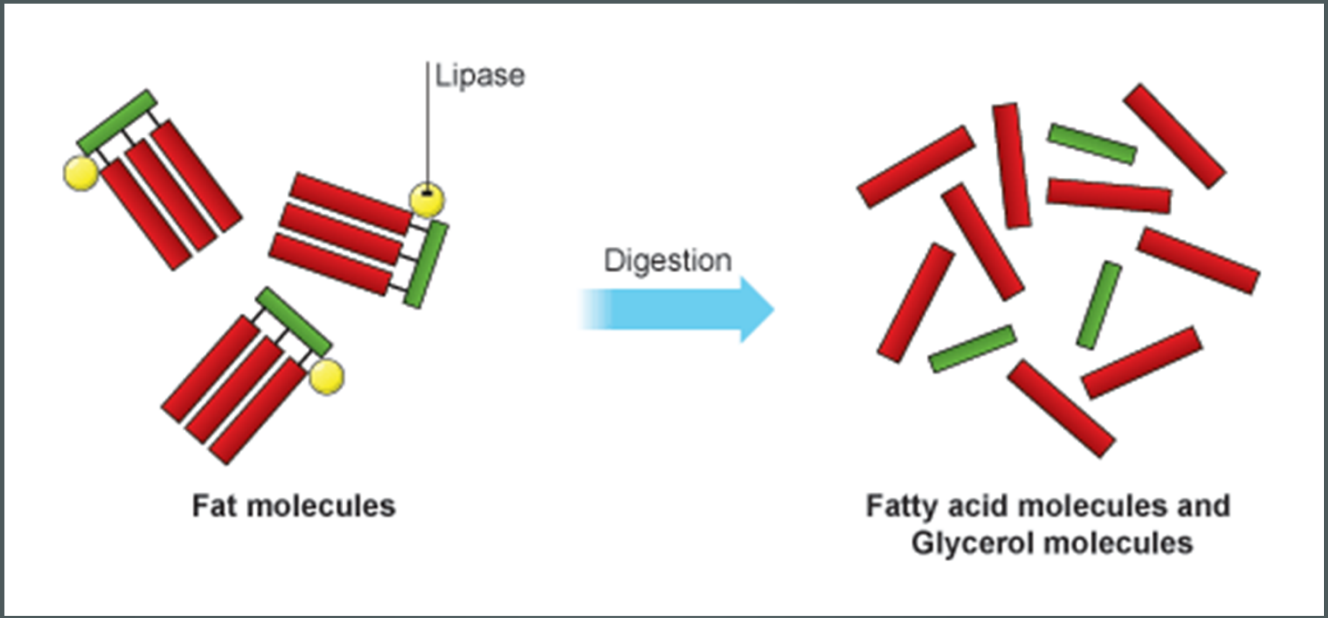
Triglycerides



Glycerol + 3 Fatty Acids → Triglyceride

Chain of Triglycerides → Lipid

LIPID BREAKDOWN



Bile and enzymes in the small intestine break **lipids** down into small molecules of **fatty acids** and **glycerol.**

NUCLEIC ACIDS

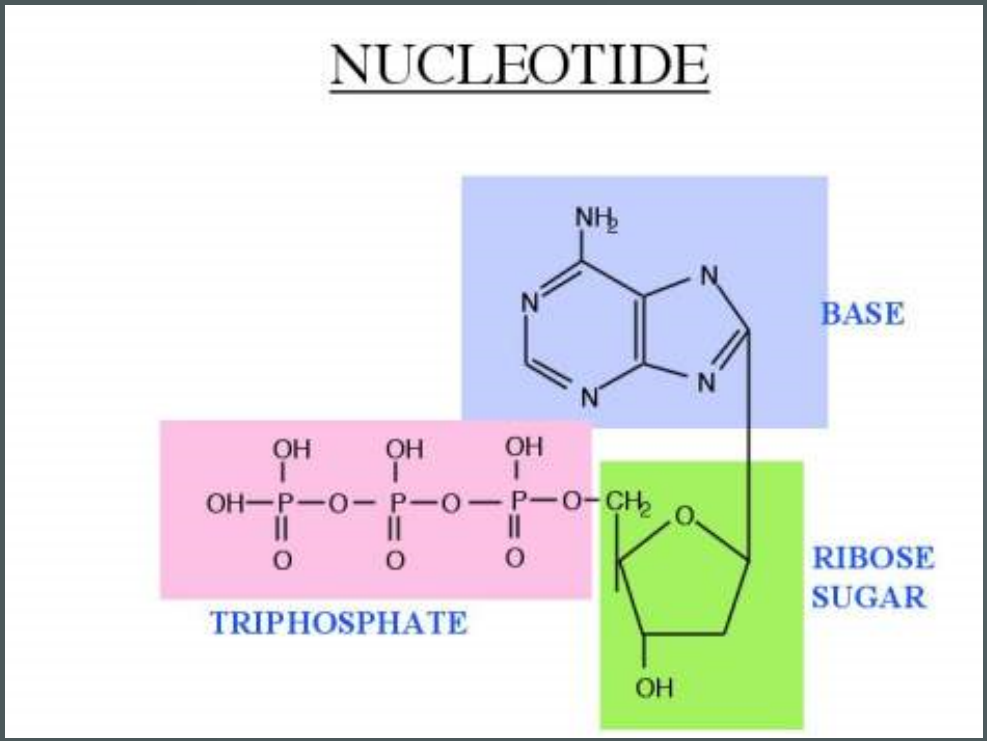
- Stores and Carries Genetic Information
- Composed of Nucleotides
- Unlike the other macromolecules, nucleic acids are not obtained from food

Deoxyribonucleic Acid (aka DNA)
Is a Nucleic Acid!

NUCLEOTIDES

All **nucleic acids** are made from combinations of **nucleotides**.

There are five nucleotides:
uracil, **cytosine**, **thymine**, **adenine**, and **guanine**



Nucleotides are made of three parts:

1. A five-carbon sugar

2. A base that has nitrogen (N) atoms

3. An ion of phosphoric acid known as phosphate ($PO4^{3-}$)