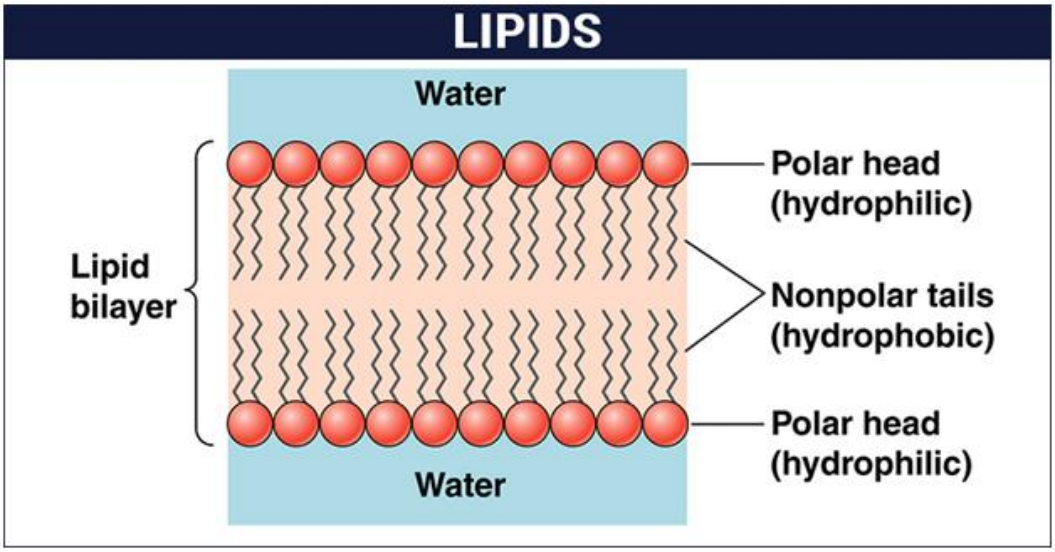
LIPIDS

Lipids are the **organic compounds** and are **nonpolar molecules,** which are soluble only in **nonpolar solvents** and insoluble in water because water is a polar molecule.

In the human body, these molecules can be synthesized in the liver and are found in oil, butter, whole milk, cheese, fried foods and also in some red meats.



Properties of Lipids

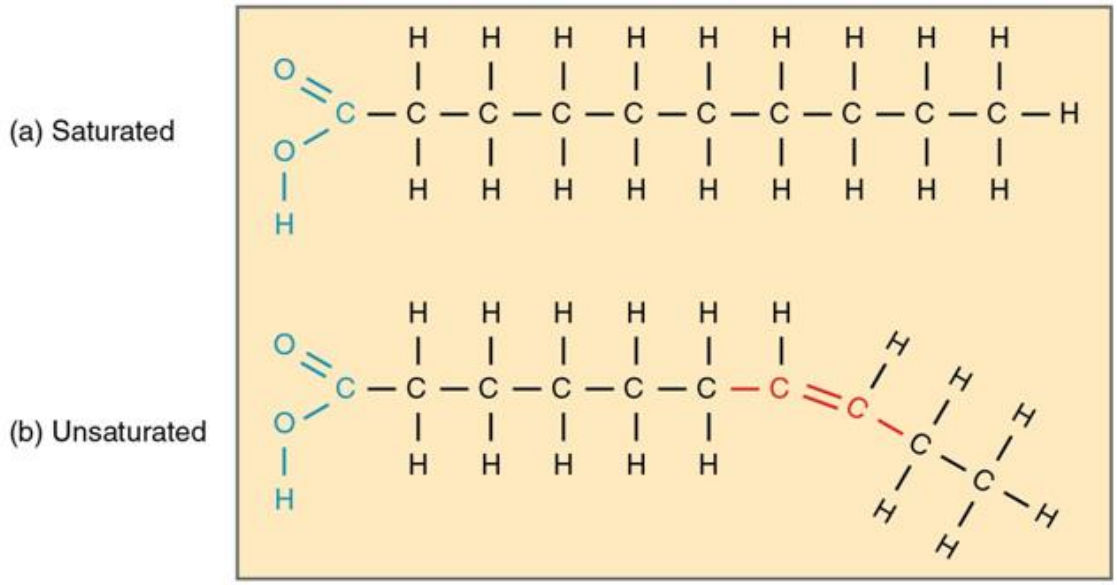
Lipids are a family of organic compounds, composed of **fats and oils.** These molecules yield high energy and are responsible for different functions within the human body.

Listed below are some important characteristics of Lipids.

1. Lipids are **oily or greasy nonpolar molecules**, stored in the adipose tissue of the body.
2. Lipids are a heterogeneous group of compounds, mainly composed of hydrocarbon chains.
3. Lipids are **energy-rich organic molecules**, which provide energy for different life processes.
4. Lipids are a class of compounds characterised by their solubility in nonpolar solvents and insolubility in water.
5. Lipids are significant in biological systems as they form a mechanical barrier dividing a cell from the external environment known as the cell membrane.

Lipid Structure

Lipids are the polymers of fatty acids that contain a long, non-polar hydrocarbon chain with a small polar region containing oxygen. The lipid structure is explained in the diagram below:



Lipid Structure – Saturated and Unsaturated Fatty Acids

Classification of Lipids

Lipids can be classified into two main classes:

- Nonsaponifiable lipids
- Saponifiable lipids

Nonsaponifiable Lipids

A nonsaponifiable lipid cannot be disintegrated into smaller molecules through **hydrolysis.** Nonsaponifiable lipids **include cholesterol, prostaglandins, etc**

Saponifiable Lipids

A saponifiable lipid comprises one or more ester groups, enabling it to undergo **hydrolysis** in the presence of a base, acid, or **enzymes,** including waxes, triglycerides, sphingolipids and phospholipids.

Further, these categories can be divided into **non-polar and polar lipids.**

Nonpolar lipids, namely **triglycerides,** are utilized as fuel and to store energy.

Polar lipids, that could form a barrier with an external water environment, are utilized in membranes. Polar lipids comprise sphingolipids and glycerophospholipids.

Fatty acids are **pivotal** components of all these lipids.

Types of Lipids

Within these two major classes of lipids, there are numerous specific types of lipids, which are important to life, including **fatty acids, triglycerides, glycerophospholipids, sphingolipids and steroids.**

These are broadly classified as **simple lipids and complex lipids.**

Simple Lipids

Esters of fatty acids with various alcohols.

1. **Fats: Esters of fatty acids** with glycerol.

   Oils are fats in the liquid state

2. **Waxes**: Esters of fatty acids with higher molecular weight monohydric alcohols

Complex Lipids

Esters of fatty acids containing groups in addition to alcohol and fatty acid.

1. **Phospholipids**: These are lipids containing, in addition to fatty acids and alcohol, phosphate group. They frequently have nitrogen-containing bases and other substituents, eg, in glycerophospholipids the alcohol is glycerol and in sphingophospholipids the alcohol is sphingosine.

2. **Glycolipids (glycosphingolipids)**: Lipids containing a fatty acid, sphingosine and carbohydrate.

3. **Other complex lipids**: Lipids such as sulfolipids and amino lipids. Lipoproteins may also be placed in this category.

Some of the different types of lipids are described below in detail.

Fatty Acids

Fatty acids are carboxylic acids (or organic acid), usually with long aliphatic tails (long chains), either unsaturated or saturated.

- **Saturated fatty acids**

Lack of carbon-carbon double bonds indicate that the fatty acid is saturated. The saturated fatty acids have higher melting points compared to unsaturated acids

- **Unsaturated fatty acids**

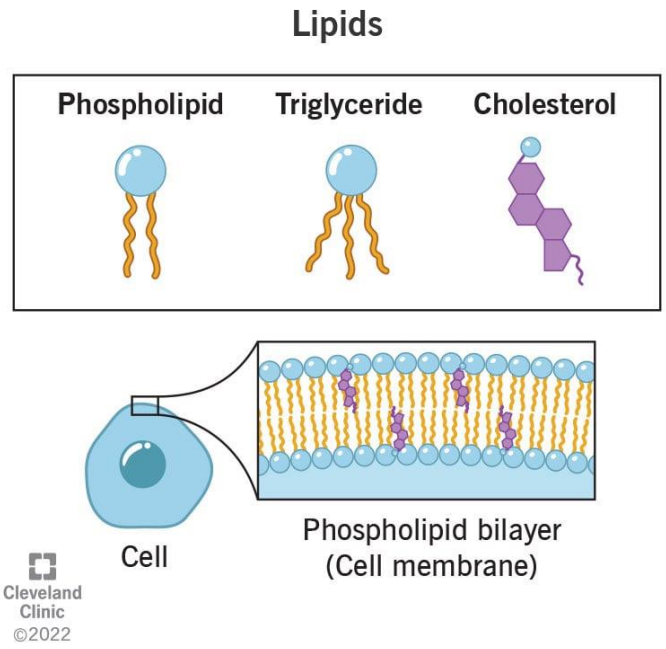
Unsaturated fatty acid is indicated when **a fatty acid** has more than **one double bond.**

Role of Fats

Fats play several major roles in our body.

Some of the important roles of fats are mentioned below:

- Fats in the correct amounts are necessary for the proper functioning of our body.
- Many fat-soluble vitamins need to be associated with fats in order to be effectively absorbed by the body.
- They also provide insulation to the body.
- They are an efficient way to store energy for longer periods.



PROTEINS

Protein is an important part of a healthy diet. Proteins are **made up of chemical 'building blocks' called amino acids**. Your body uses amino acids to build and repair muscles and bones and to make hormones and enzymes. They can also be used as an energy source.

PROTEIN RICH FOODS

1. Fish

2. Seafood

3. Skinless, white-meat poultry

4. Lean beef (including tenderloin, sirloin, eye of round)

5. Skim or low-fat milk

6. Skim or low-fat yogurt

7. Fat-free or low-fat cheese

8. Eggs

9. Lean pork (tenderloin)

10. Beans

NUCLEIC ACIDS

Nucleic acids are **large biomolecules** that play essential roles in all **cells and viruses**. A major function of nucleic acids involves the **storage and expression of genomic information**. Deoxyribonucleic acid, or DNA, encodes the information cells need to make proteins.

Modified **Nucleosides in Genomic DNAs**.

During the period 1920-45, naturally occurring nucleic acid polymers (DNA and RNA) were thought to contain only **four canonical nucleosides** (ribo-or deoxy-derivatives): **adenosine, cytosine, guanosine, and uridine or thymidine**.

ENZYMES

1. The body produces enzymes, which are essentially proteins, to carry out specific **metabolic and biochemical reactions.**
2. They are **biological catalysts** that quicken internal chemical reactions.
3. However, the process has no effect on the structure or makeup of the enzymes.
4. Examples include **lipases, amylase, maltase, and trypsin.**

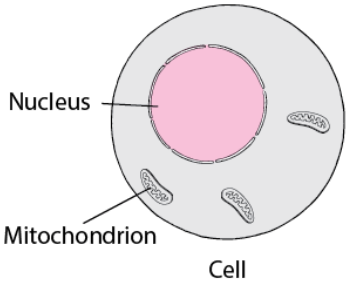
VITAMINS:

1. Vitamins are natural, **important nutrients** that are needed in small amounts for a variety of biological processes, including growth and development, **wound healing, bone and tissue maintenance, immune system health, and other bodily processes.**
2. There are **fat-soluble vitamins A, D, E, and K** while water-soluble vitamins are B and C.
3. **Vitamin A, B, C, D,E and K** are a few examples of it.
4. Vitamin D is produced by the cells of the skin when the sunlight containing UV rays falls on the exposed skin.

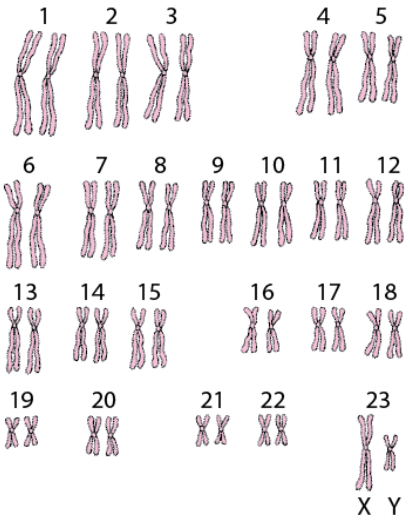
GENES AND CHROMOSOMES

A gene is a **section of DNA** which is involved in carrying information for a particular trait. They are **functional units of heredity** and are made of DNA.

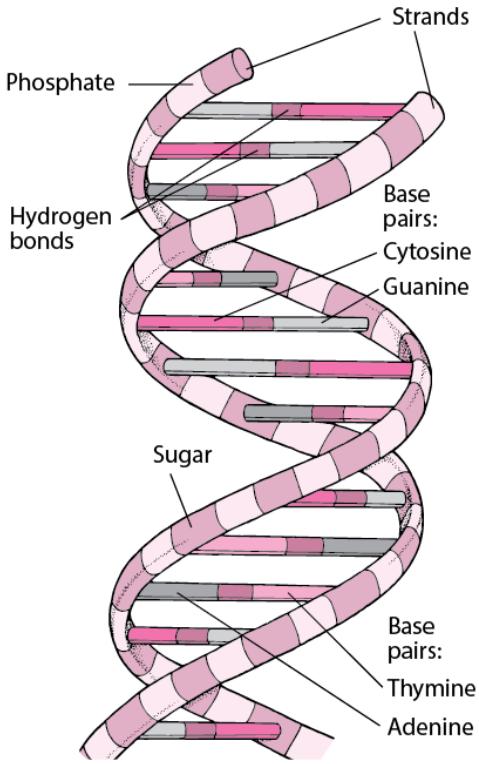
Genes are responsible for the hereditary and this is the reason why we all have similar **characteristics** of both the parents like **the pigmentation of the eye, hair color**, etc. There are about 29 to 30 thousands of genes in every cell of the human body. The term gene was first coined in the year 1909 by a Danish botanist **Wilhelm Johannsen.**



Cell



Pairs of Chromosomes in a Human Cell



DNA Double Helix

Chromosomes

Chromosomes are **thread-like structures** merged together and are made of proteins and a **single molecule of deoxyribonucleic acid** – DNA. They are mainly found inside the nucleus of both animal and plant cells. They are passed to offspring from their parents, over generations.

The term **chromosome** is derived from the Ancient Greek word meaning coloured body. Every human cell contains 46 or 23 pairs of chromosomes. These chromosomes play an