BIOMOLECULE

It is an organic compound normally present as an essential component of living organisms.

Carbohydrates

- Carbohydrates (polysaccharides) are long chains of sugars.
- A carbohydrate is a biological molecule consisting of carbon (C), hydrogen (H) and oxygen (O) atoms, in other words, with the empirical formula $C_m(H_2O)_n$
- The primary function of carbohydrates is for short-term energy storage.
- A secondary function is intermediate-term energy storage (as in starch for plants and glycogen for animals).

Carbohydrates are 3 types:

- **Monosaccharides** are the simplest form of carbohydrates with only one simple sugar. e.g. Glucose - Fructose - Galactose
- **Disaccharides** are formed when two monosaccharides, or two single simple sugars, form a bond with removal of water. e.g. Lactose-Sucrose-Maltose
- **Polysaccharides** are polymerized monosaccharides, or complex carbohydrates. e.g. Starch- Glycogen-Cellulose

Proteins

- Proteins are heteropolymers of strings of amino acids. Amino acids are joined together by the peptide bond which is formed in between the carboxyl group and amino group of successive amino acids.

- Animal Protein contains the most biological value because it contains all essential amino acids (Meat, Milk, Fish, Eggs, etc.)
- Plant Protein contains a lower biological value to humans because it contains fewer essential amino acids (Cereals, Peas, Beans, etc.)
- Protein is known as 'bodybuilding food'. Kwashiorkor is a form of malnutrition caused by a lack of protein in the diet.
- Proteins perform a vast array of functions within organisms, including catalyzing metabolic reactions, DNA replication, responding to stimuli, providing structure to cells and organisms, and transporting molecules from one location to another.

Lipids (fats)

- Lipids are fatty compounds that perform a variety of functions in your body. They help with moving and storing energy, absorbing vitamins and making hormones.
- Lipids are composed of long hydrocarbon chains. Lipid molecules hold a large amount of energy and are energy storage molecules.
- Fatty acids can be unsaturated and saturated fatty acids. e.g. oils, fats, phospholipids, glycolipids, etc.
- 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.

Roughage or Dietary Fiber or Bulk

- It includes the parts of plant foods your body can't digest or absorb.
- Fiber is commonly classified as **soluble,** which dissolves in water, or **insoluble**, which doesn't dissolve.

- **Soluble fiber** dissolves in water to form a gel-like material. It can help lower blood cholesterol and glucose levels. It is found in oats, peas, beans, apples, citrus fruits, carrots, barley and psyllium.
- **Insoluble fiber** promotes the movement of material through your digestive system and increases stool bulk, so it can be of benefit to those who struggle with constipation or irregular stools.
- Whole wheat flour, wheat bran, nuts, beans and vegetables, are good sources of insoluble fiber.

Vitamin

- A vitamin is defined as an organic compound and a vital nutrient that an organism requires in limited amounts.
- It cannot be synthesized in sufficient quantities by an organism, and must be obtained from the diet.
- There are two types of vitamins: fat soluble and water-soluble.
- Fat-soluble (Vitamins A, D, E, and K) requiring fat in order to be absorbed.
- Water-soluble vitamins (Vitamin B & C) are not stored in your body; Therefore, they need to be replenished daily.

Vitamin Sources and Deficiency & Sufficiency Diseases Chart

Vitamin	Chemical Name	Deficiency disease	Sufficiency disease	Food sources
Vitamin A	Retinol, retinal, and carotenoids	Nightblindness, Hyperkeratosis, and Keratomalacia	Hypervitaminosis A	Orange, ripe yellow fruits, leafy vegetables, carrots, pumpkin, squash, spinach, liver, soy milk, milk
Vitamin B_1	Thiamine	Beriberi, Wernicke -Korsakoff syndrome	Drowsiness or muscle relaxation with large doses	Pork, oatmeal, brown rice, vegetables, potatoes, liver, eggs
Vitamin B_2	Riboflavin	Ariboflavinosis		Dairy products, bananas, popcorn, green beans, asparagus
Vitamin B_3	Niacin, niacinamide	Pellagra	Liver damage andother problems	Meat, fish, eggs, many vegetables, mushrooms, tree nuts
Vitamin B_5	Pantothenic acid	Paresthesia	Diarrhea; possibly nausea and heartburn.	Meat, broccoli, avocados
Vitamin B_6	Pyridoxine, pyridoxamine, pyridoxal	Anemia peripheral neuropathy	Impairment of proprioception, nerve damage	Meat, vegetables, tree nuts, bananas
Vitamin B_7	Biotin	Dermatitis, enteriti s		Raw egg yolk, liver, peanuts, certain vegetables
Vitamin B_9	Folic acid, folinic acid	Megaloblastic anemia and Deficiency during pregnancy is associated with birth defects, such as neural tube defects	May mask symptoms of vitamin B_{12} deficiency; Other effects.	Leafy vegetables, pasta, bread, cereal, liver
Vitamin B_{12}	Cyanocobalami n, methylcobalami n	Megaloblastic anemia	Acne-like rash	Meat and other animal products
Vitamin C	Ascorbic acid	Scurvy	Vitamin C megadosage	Many fruits and vegetables, liver
Vitamin D	Cholecalciferol, Ergocalciferol	Rickets and Osteomalacia	Hypervitaminosis D	Fish, eggs, liver, mushrooms
Vitamin E	Tocopherols, tocotrienols	Deficiency is very rare; mildhemolytic anemia in newborn infants.	Increased congestive heart failure seen in one large randomized study.	Many fruits and vegetables, nuts and seeds
Vitamin K	phylloquinone, menaquinones	Bleeding diathesis	Increases coagulation in patients taking warfarin.	Leafy green vegetables such as spinach, egg yolks, liver

Mineral Nutrients or Dietary Mineral

Minerals are among the essential elements required by the body including carbohydrates, proteins, fats, vitamins and water.

These are two types, such as Macronutrients and Micronutrients.

Macronutrients

Elements which are present in large amounts in plant tissues are called macronutrients. e.g. Carbon, hydrogen, oxygen, nitrogen, phosphorus, sulphur, potassium, calcium and magnesium.

Micronutrients or Trace Elements

Elements which are present in small amounts, e.g. Iron, manganese, copper, molybdenum, zinc, copper, boron, chlorine and nickel.

Minerals and their Function in the Human body

Mineral	Major Food Source	Functions	Deficiency Diseases
		Macronutrients	
Calcium Ca	milk, dairy products, green leafy vegetables, fish	Muscle contraction, nerve action, blood clotting and the formation of bone.	Tetany & rickets
Chlorine Cl	Salted food and seafood.	Anion/cation balance and gastric acid formation.	Loss of appetite muscle cramps.
Magnesium Mg	meat, whole grains, nuts, legumes, apricots, bananas, chocolate and green vegetable	Formation of bone, formation of coenzymes in cell respiration.	Irregularity of metabolism, Fatigue, poor memory, muscle twitching and rapid heartbeat.
Phosphorus P	Cheese, eggs, pea nuts and most foods.	Bone and tooth formation, energy transfer from foods, DNA, RNA and ATP formation.	Tetany & rickets
Potassium K	meat, chocolate, oranges, bananas, peanuts, beans, potatoes, spinach	Muscle contraction, nerve action, active transport.	Nervous disorder, poor muscles leading to paralysis.

Sodium Na	Any salted food, meat, eggs and milk.	Muscle contraction, nerve action and active transport.	Fatigue, Nervous, depression, muscular cramps, PH dis-balance
Micronutrients (Trace Elements)			
Iron Fe	Liver, kidney, red meat, cocoa powder and water-cress, green leaf	Helps the blood and muscles carry oxygen to the body.	Anemia and low immunity.
Fluorine F	salt water fish (salmon), tea, sea food, meat, liver, beans, fluoridated water	Helps to make bones and teeth stronger. Improves resistance to cavities.	Weak teeth and bones.
Zinc Zn	Meat, liver and beans.	Enzyme activation and carbon dioxide transport.	Anemia, weak immunity and fertility.
Copper Cu	beans, raisins, chocolate, nuts, meat, shellfish	Enzyme, melanin and hemoglobin formation.	Anemia, weak blood vessels and connective tissues.
Iodine I	Seafood, iodized salt and fish.	Thyroxin production	Goitre - enlargement of the thyroid gland.
Manganese Mn	Tea, nuts, spices and cereals.	Bone development and enzyme activation.	Irregular growth of bones and connective tissues.

WATER

- All biochemical reactions occur in water. It fills the spaces in and between cells and helps form structures of large molecules such as protein and glycogen.
- About 70% of the human body consists of water.