**ASSIGNMENT 1**

1. Giving two examples for each, define the following terms:
   1. Food

Food is any nutritious and delicious substance that people or animals eat or drink, or that plant absorb, in order to maintain life and growth. Food gives living things energy for doing an activity, build, repair and protect the body from diseases. Example includes beef, veal, lamb, pork, fish and chicken. Other foods come from plants, including rice, wheat, fruit, beans and vegetables. Also, eat food that animals make. For example, chickens produce eggs and cows give milk.

* 1. Nutrients

Nutrients are chemical substances that provides nourishment essential for growth and the maintenance of life/body processes. There are six categories of nutrients, which include the following;

1. Organic nutrients like Proteins; proteins build and repair body tissues, Carbohydrates; carbohydrates provides energy, Lipids; lipids/fats provides energy and Vitamins regulates the body processes.
2. Inorganic nutrients like Minerals and water all these regulate the body processes.
   1. Nutrition

Nutrition is the science that interprets the interaction of nutrients and other substance in food in relation to maintenance, growth, reproduction, health and diseases of an organism. It includes food intake (ingestion), digestion, assimilation, transportation, utilization and excretion of food substances.

1. Distinguish between dispensable and indispensable nutrients

* Dispensable nutrients sometimes called nonessential amino acids fill essential roles. Dispensable nutrients or nonessential amino acids support tissue growth and repair, immune function, red blood cell formation, and hormone synthesis. However, unlike essential amino acids, a healthy body can create these proteins if given enough protein sources with essential amino acids. There are 11 nonessential amino acids: arginine, glutamine, tyrosine, cysteine, glycine, proline, serine, ornithine, alanine, asparagine, and aspartate.
* Indispensable nutrients also known as essential amino acids. There are nine essential amino acids: histidine, isoleucine, leucine, lysine, methionine, phenylalanine, threonine, tryptophan, and valine. These nutrients cannot be produced and stored by the body, it is important to regularly supply the body with these important building blocks.

1. Suggest a reason why protein deficiency/inadequacy would interfere with the process of digestion.

* Dietary proteins elicit a wide range of nutritional and biological functions. Beyond their nutritional role as the source of amino acids for protein synthesis, they are instrumental in the regulation of food intake, glucose and lipid metabolism, blood pressure, bone metabolism and immune function.
* The interaction of dietary proteins and their products of digestion with the regulatory functions of the gastrointestinal tract (GI) plays a dominant role in determining the physiological properties of proteins.
* The site of interaction is widespread, from the oral cavity to the colon. The characteristics of proteins that influence their interaction with the gastrointestinal tract GI in a source-dependent manner include their physico-chemical properties, their amino acid composition and sequence, their bioactive peptides, their digestion kinetics and the non-protein bioactive components conjugated with them. Within the gastrointestinal tract GI , these products affect several regulatory functions by interacting with receptors releasing hormones, affecting stomach emptying and GI transport and absorption, transmitting neural signals to the brain, and modifying the microflora.

1. Giving specific examples, explain what you understand by the term enzyme specificity.

* The term Enzyme refers to biological catalysts that accelerates the rate of metabolic/ chemical reactions in the cells by reducing the activation energy of the reactants. Enzymes are specialized proteins with definite structural conformations.
* Enzyme specificity is the ability of an enzyme to choose exact substrate from a group of similar chemical molecules. The specificity is actually a molecular recognition mechanism and it operates through the structural and conformational complementarity between enzyme and substrate.
* The specificity is shown by enzymes which are grouped into six categories;

1. Bond specificity; this is called relative specificity. Enzymes showing bond specificity are bond specific to substrate having similar bonds and similar structure. Meaning they are specific only to certain types of bonds such as peptides, glycosides bonds.
2. Group specificity; is also called moderate specificity, here the enzyme is specific to a bond and groups surrounding the bonds. Group specificity is more than that of bond specificity. Endopeptidase and exopeptidase are the classical examples for group specificity.
3. Substrate specificity; Substrate specificity is sometimes called absolute specificity. Enzymes showing substrate specificity are specific to one substrate and one reaction.
4. Stereo specificity; sometimes-called optical specificity of enzymes. The enzyme here is only specific not only to substrate but also to its optical configuration. It is considered as the highest specificity shown by aby class of enzymes.
5. Geometrical specificity; In geometrical specificity, single enzymes can act on different substrates having similar molecule geometry and hence specificity is very less. Example is Alcohol dehydrogenase can oxidize both ethanol and methanol to yield corresponding aldehydes since both theses alcohols have similar molecular geometry.
6. Co-factor specificity; Co-factors are non-protein part of enzyme required for the functioning of some enzymes. Enzymes which requires co-factors for their activity shows co-factor specificity.
7. Explain what you understand by the term antinutrients.

Antinutrients are plant compounds that reduce the body's ability to absorb essential nutrients.

The below are the antinutrients that reduces the body’s ability to absorb important nutrients in the body;

1. **Phytate (phytic acid):** Mainly found in seeds, grains and legumes, [phytate](https://www.healthline.com/nutrition/phytic-acid-101/) reduces the absorption of minerals from a meal. These include iron, zinc, magnesium and calcium.
2. **Tannins:** A class of antioxidant polyphenols that may impair the digestion of various nutrients.
3. **Lectins:** Found in all food plants, especially in seeds, legumes and grains. Some [lectins](https://www.healthline.com/nutrition/dietary-lectins/) may be harmful in high amounts, and interfere with the absorption of nutrients.
4. **Protease inhibitors:** Widely distributed among plants, especially in seeds, grains and legumes. They interfere with [protein](https://www.healthline.com/nutrition/how-much-protein-per-day/) digestion by inhibiting digestive enzymes.
5. **Calcium oxalate:** The primary form of calcium in many vegetables, such as spinach. The calcium bound to oxalate is poorly absorbed.
6. Explain three functions of bile in the digestion of lipids.

#### Bile contains bile acids, which are critical for digestion and absorption of fats and fat-soluble vitamins in the small intestine.

#### Role of Bile Acids in Fat Digestion and Absorption is clearly explained below;

* Bile acids are derivatives of cholesterol synthesized in the hepatocyte. A hepatocyte is a cell of the main parenchymal tissue of the liver. Hepatocytes make up 70-85% of the liver's mass. These cells are involved in Protein synthesis. Cholesterol, ingested as part of the diet or derived from hepatic synthesis is converted into the bile acids cholic and chenodeoxycholic acids, which are then conjugated to an amino acid (glycine or taurine) to yield the conjugated form that is actively secreted into canaliculi.
* Bile acids are facial amphipathic, that is, they contain both hydrophobic (lipid soluble) and polar (hydrophilic) faces. The cholesterol-derived portion of a bile acid has one face that is hydrophobic (that with methyl groups) and one that is hydrophilic (that with the hydroxyl groups); the amino acid conjugate is polar and hydrophilic.
* Emulsification of lipid aggregates: Bile acids have detergent action on particles of dietary fat, which causes fat globules to break down or be emulsified into minute, microscopic droplets. Emulsification is not digestion but is of importance because it greatly increases the surface area of fat, making it available for digestion by lipases, which cannot access the inside of lipid droplets.
* Solubilization and transport of lipids in an aqueous environment: Bile acids are lipid carriers and are able to solubilize many lipids by forming micelles aggregates of lipids such as fatty acids, cholesterol and monoglycerides that remain suspended in water. Bile acids are also critical for transport and absorption of the fat-soluble vitamins.

1. Many waste products, including bilirubin, are eliminated from the body by secretion into bile and elimination in feces.
2. Explain how proteins differ structurally from carbohydrates and lipids.

* The major differences between carbohydrates and proteins include their structure and function inside the cell. Carbohydrates are made of the elements carbon, hydrogen and oxygen. They are used for quick energy inside cells, where glucose is converted to Adenosine triphosphate (ATP) energy during cellular respiration.
* Proteins are made of the elements carbon, hydrogen, oxygen, nitrogen and sulfur. They are used for structure and support in the body. For example, keratin is a protein that makes up our hair and nails and collagen is an important protein in building the structure of our skin. Proteins also have important jobs as enzymes inside the cell. Enzymes are protein catalysts that speed up chemical reactions. They are needed to carry out all processes inside cells, such as synthesizing deoxyribonucleic acid (DNA), making energy, and creating new structures.
* Fats, a subgroup of lipids, are also known as triglycerides, meaning their molecules are made from one molecule of glycerol and three fatty acids. Proteins are polymers of hundreds or even thousands of amino acids. Each protein has a different structure and performs a different function in the body.

Reference

1. <https://www.betterhealth.vic.gov.au/health/HealthyLiving/foods-from-plants-and-animals>
2. <https://academic.oup.com/jn>
3. <https://draxe.com/antinutrients/>