Africa Institute for Project Management Studies

Assignment 1

PGD004 - Post Graduate Diploma in Human Nutrition

JULY 31, 2018

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ASSIGNMENT 1

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

a. Food

Food is anything edible, it includes all materials and drinks acceptable for the particular society, culture or religion.

Food can also be defined as any material consisting essentially of protein, carbohydrate, and fat used in the body of an organism to sustain growth, repair, and vital processes and to furnish energy; also **:** such material together with supplementary substances (as minerals, vitamins, and condiments) according to Dictionary by Merriam-Webster: America's most-trusted online dictionary

The below table gives the examples of the foods

S/NO	Food	Example	
1.	Vegetables and legumes/beans	**Dark green or cruciferous/brassica** • Broccoli, brussels sprouts, bok choy, cabbages, cauliflower, kale • Lettuce, silverbeet, spinach, snow peas **Root/tubular/bulb vegetables** • Potato, cassava, sweet potato, taro, carrots, beetroot, onions, shallots, garlic, bamboo shoots, swede, turnip **Legumes/beans** • Red kidney beans, soybeans, lima beans, cannellini beans, chickpeas, lentils, split peas, tofu **Other vegetables** • Tomato, celery, sprouts, zucchini, squash, avocado, capsicum, eggplant, mushrooms, cucumber, okra, pumpkin, green peas, green beans	
2.	Fruit	apples and pears berries citrus fruit such as oranges, mandarins and grapefruit grapes and passionfruit. stone fruit such as apricots, cherries, peaches, nectarines and plums tropical fruit such as bananas, paw paw, mangoes, pineapple and melons	

3.	Grain (cereal) foods, mostly wholegrain and/or high cereal fibre varieties	Grains (cereal) foods can be broken up into four main groups. The main sub-groups are: • Breads - Wholemeal, wholegrain, white, rye, pita, lavash, naan, focaccia, crispbreads, damper • Breakfast Cereals - Ready to eat, high fibre (wholegrain) oats, porridge, muesli, wholewheat biscuits • Grains - Rice, barley, corn, polenta, buckwheat, spelt, millet, sorghum, triticale, rye, quinoa, semolina • Other products - Pasta, noodles, English muffin, crumpet, rice cakes, couscous, bulgur, popcorn, flour.	
4.	Lean meats and poultry, fish, eggs, tofu, nuts and seeds and legumes/beans	Foods from this food group fall into 6 categories. Examples include: Lean meats - Beef, lamb, veal, pork, kangaroo, lean (lower salt) sausages Poultry - Chicken, turkey, duck, emu, goose, bush birds Fish and seafood - Fish, prawns, crab, lobster, mussels, oysters, scallops, clams Eggs - Chicken eggs, duck eggs Nuts and seeds - Almonds, pine nuts, walnut, macadamia, hazelnut, cashew, peanut, nut spreads, pumpkin seeds, sesame seeds, sunflower seeds, brazil nuts Legumes/beans - All beans, lentils, chickpeas, split peas, tofu.	
5.	Milk, yoghurt cheese and/or alternatives, mostly reduced fat	Examples of milk, yoghurt, cheese and/or alternatives include: 1. Milks - All reduced fat or full cream milks, plain and flavored, long life milks, powdered milk, evaporated milk, soy beverages (fortified with at least 100mg calcium/100mL) 2. Yoghurt - All yoghurts including reduced fat or full cream, plain and flavored, soy yoghurt (calcium fortified) 3. Cheese - All hard cheeses, reduced or full fat for example cheddar, red Leicester, Gloucester, Edam, Gouda Soy cheeses (calcium fortified).	

b. Nutrients

According to Jan Modroc, the author of articles on Nutrients review.com, is a health writer who has finished medical faculty in the University of Ljubljana, Slovenia and has written articles for several health websites. "Nutrient is any substance that is absorbed and either provides body with energy or enables growth, repair or proper functioning of your body".

Basically there are 6 Classes of Nutrients
1. Carbohydrates 2. Lipids (fats) 3. Proteins 4. Vitamins 5. Minerals 6. Water

Examples of nutrients and their functions:

- Starch and its breakdown product glucose provides energy.
- Proteins build muscles and form enzymes.
- Lipids form the cell membranes and certain hormones.
- Potassium and sodium enable the proper functioning of the nerves.
- Vitamin C is necessary for the wound healing.

A nutrient is also an active chemical component in food that plays a specific structural or functional role in the body's activity. Sugars, starches and fibre are often grouped together as they are all carbohydrates. Vitamins and minerals are needed in very small amounts and they are called micronutrients.

-
- Almost all foods are a mixture of nutrients.
- Or
- Nutrients can be define as substances in foods that are needed for growth and maintenance of a heathy body

➢ Essential nutrients

Nutrients the body either cannot make or cannot make enough of to maintain health and it should be obtained from foods (ingested in some manner)
Examples: Vitamins, Calcium, iron, and other minerals and Some of the amino acids

➢ Nonessential nutrients – body can make from other nutrients ingested
→ Examples: Cholesterol and Some amino acids
➢ Organic nutrients - contain carbon examples includes ,Carbohydrates, Lipids, Proteins and Vitamins
➢ Inorganic nutrients - are the nutrients that do not contain carbon, Minerals, Water

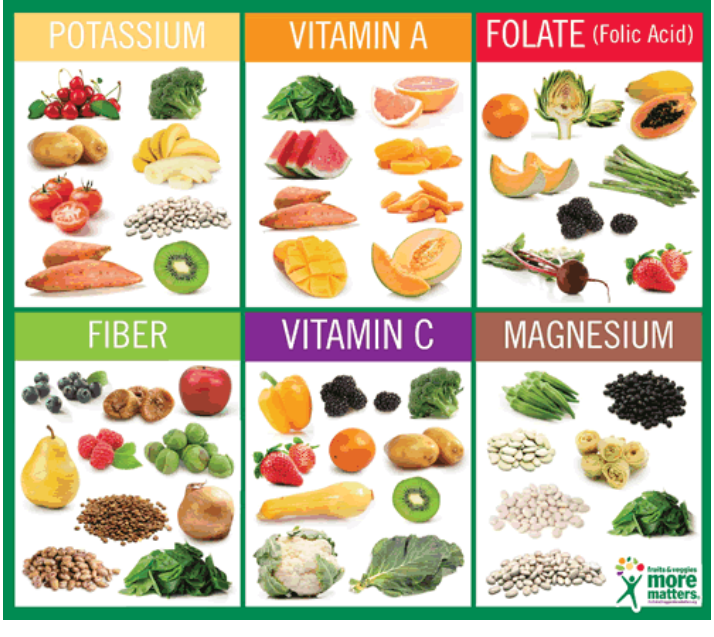
C. Nutrition

is the act or process of nourishing or being nourished; specifically **:** the sum of the processes by which an animal or plant takes in and utilizes food substances (merriam webster,1828) dictionary or Nutrition is the interaction between food and the body.
An **example of nutrition** is the **nutrients** found in fruits and vegetables.

Key Nutrients in Fruits & Vegetables

The Dietary Guidelines for Americans calls for all Americans to eat more nutrient-rich foods. **Fruits and vegetables can be great sources of the following important nutrients.** Click the links to see a list of fruits & veggies that carry the label of "high" and "good" sources for these nutrients.

- **Calcium:** Calcium is essential for healthy bones and teeth. It is also needed for normal functioning of muscles, nerves and some glands.
- **Fiber:** Diets rich in dietary fiber have been shown to have a number of beneficial effects, including decreased risk of coronary heart disease.
- **Folate:** Healthful diets with adequate folate may reduce a woman's risk of having a child with a brain or spinal cord defect.
- **Iron:** Needed for healthy blood and normal functioning of all cells.
- **Magnesium:** Magnesium is necessary for healthy bones and is involved with more than 300 enzymes in your body! Inadequate levels may result in muscle cramps and high blood pressure.
- **Potassium:** Diets rich in potassium may help to maintain a healthy blood pressure.
- **Sodium:** Needed for normal cell function throughout the body. Most diets contain too much sodium which is associated with high blood pressure.
- **Vitamin A:** Keeps eyes and skin healthy and helps protect against infections.
- **Vitamin C:** Helps heal cuts and wounds and keeps teeth and gums healthy.



2. Distinguish between dispensable and indispensable nutrients

Indispensable nutrients- body cannot manufacture them in sufficient quality or at all. Needed in the diet. Dispensable Nutrients- can be made by the body needed for healthy life, not needed in die

Every day we consume food to nourish and fuel our body, as eating many different nutrients that are essential to maintaining optimal health. These are called essential nutrients and include vitamins, minerals, proteins, fats and carbohydrates. However, some nutrients are made in the human body, and these are called non-essential nutrients. Although termed non-essential, they are still required by the body for supporting daily bodily processes. Some non-essential nutrients are also found in the diet, although many are also made by the body.

Essential Nutrients

The body need a variety of proteins, fats and carbohydrates every day because these are the precursors of energy, amino acids and essential fatty acids, as well as containers of essential vitamins, minerals, and phytonutrients. Essential nutrients include the following:

Non-Essential Nutrients

Non-essential nutrients are still needed every day but you don't have to worry as much about them because some are synthesized by the body.

Some non-essential nutrients include the following:

Non-Essential Amino Acids

Non-essential amino acids are those amino acids that can generally be synthesized from the diet when there are enough of the essential amino acids available.

The list of non-essential amino acids includes:

- Alanine, Arginine
- Asparagine
- Aspartic acid

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

Dietary vitamin B-12 is bound to a protein. In order for the vitamin to be absorbed, the protein must be stripped away. Gastric juices and pepsin are part of the cleavage process. Pepsin also cleaves nonheme iron -- which is found in plant foods such as cereals, fruits and vegetables -- from a protein to facilitate absorption (Carolyn Robbins, 2017).

by VITA RUVOLO-WILKES Aug. 14, 2017 Vita Ruvolo-Wilkes
Vita Ruvolo-Wilkes was first published in 1977. She worked as a certified aerobics and exercise instructor. Upon graduating from the Wake Forest University School of Medicine, she worked for the VA Medical Center. As a physician assistant, Ruvolo-Wilkes designed specialized diets for her patients' conditions and has written a monthly health column in the "Montford Newsletter."

Digestion occurs in three phases. First, nutrients receive secretions from the pancreas and gall bladder, which begin the breakdown of food into its individual components. Next, the small intestine uses its brush border enzymes to further hydrolyze the food into absorbable molecules. Finally, the small intestine absorbs the nutrients into its walls for use in your body's nourishment. The waste that remains after absorption moves into the large intestine where it gets transported out of the body. If anything goes awry in any stage of this process, malabsorption results.

Physiology

The digestive process begins as soon as food enters your mouth. The enzymes in your saliva and the process of chewing change the bite of food into a bolus -- chewed but undigested food matter. When you swallow, your throat thrusts the bolus into your esophagus, where the muscular contractions of its walls pass it to the stomach. When the bolus enters the stomach, acids and enzymes churn it into smaller bits of food. Only after the matter enters the small intestine and goes through the three stages of absorption does the bite of food you ingested break into individual molecules small enough to pass through the wall of your small intestine and provide nourishment to your body.

Protein Deficiency: Overview

Alternative names: The most severe forms of Protein Deficiency are called Marasmus and Kwashiorkor.

Protein is an essential component of the body. The organs, muscle, brain, nerves, and immune system are all, to some degree, comprised of protein. You name the body structure, and it probably has some protein in it. Since protein is one of the fundamental building blocks for the body, you need to ensure that you get enough in your diet.

Some 20% of the human body is made up of protein, which plays a crucial role in almost all biological processes. Every protein molecule is composed of amino acids. Twenty amino acids are used in different combinations to build the protein molecules found in food and in the body's structures. Nine of these amino acids are considered essential, and must be supplied through the diet. The other eleven amino acids (non-essential amino acids) can either be consumed in the diet or manufactured from other building blocks within the body.

Protein deficiency is generally higher among vegetarians, vegans and elderly people, and pregnant women are also at greater risk.

Protein Deficiency can also be a consequence of Cachexia, or Wasting Syndrome, which often occurs in cancer patients or those with certain diseases such as AIDS, kidney failure, or COPD.

The main risk factors for Protein Deficiency are poor diet, not eating enough, and pregnancy.

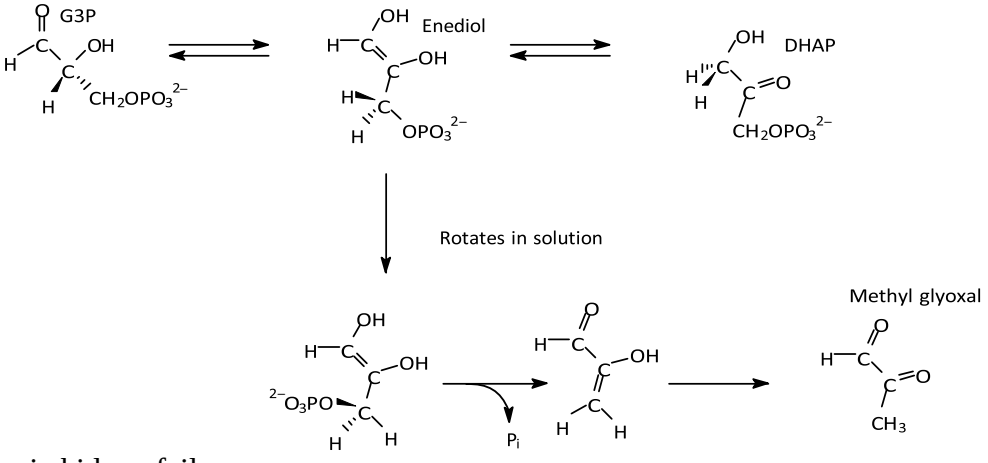
Signs and Symptoms

Protein is a part of nearly everything in our bodies: skin, hair, nails, bones, muscles and blood are all largely made of protein. The symptoms of protein deficiency can therefore take many different forms, including:

- Apathy
- Anxiety and moodiness (proteins are involved in the synthesis of hormones such as dopamine and serotonin, and these help produce positive feelings like calm, excitement and positivity)
- Depression
- Insomnia (consuming protein before bed can help with the production of tryptophan and serotonin, which promote sound sleep)
- Chronic headaches
- Blackouts
- Nausea
- Constipation and gas (protein deficiency can negatively affect enzyme production, muscle contractions in the GI tract, and digestion in general)
- Diarrhea
- Reduced blood pressure
- High cholesterol and triglycerides (due to the liver processing fats less efficiently)
- Growth problems in children
- Edema (fluid retention)

Other possible conditions that may arise from a protein deficiency include:

- Fatty Liver Disease (Hepatic Steatosis) – protein is involved in the transport of lipoproteins and cholesterol, so a lack of protein can lead to this condition.



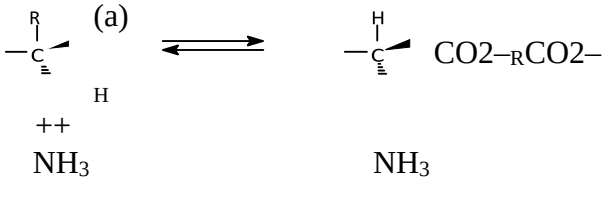
- Chronic kidney failure
- Increased risk of muscle loss, falling, slow bone healing, bone weakness, fractures and osteoporosis. Protein is required for calcium absorption and bone metabolism.

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

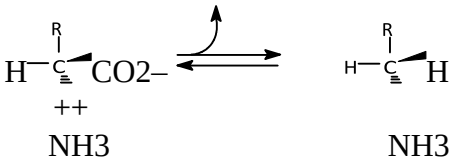
According to encyclopedia of life science/ and 2001 nature publishing Group/www. Els.net, Specificity is a hallmark of enzyme catalysis; it is inseparable from catalytic efficiency, the other hallmark of enzyme reactions. Specificity arises from the three dimensional structure of the enzyme active site; this site is complementary to the transition state of the reaction. The substrate fits snugly within the enzyme active site,

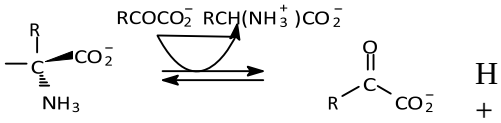
Figure 3The triose-phosphate isomerase reaction.

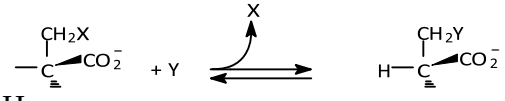
Racemization, → Decarboxylation → Transamination → β-Elimination/replacement →γ-Elimination/replacement



CO_2



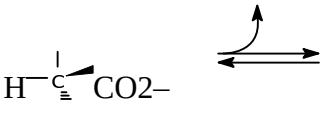




H

\+ + NH3 NH3

X



CH_2CH_2X CH CH_2Y

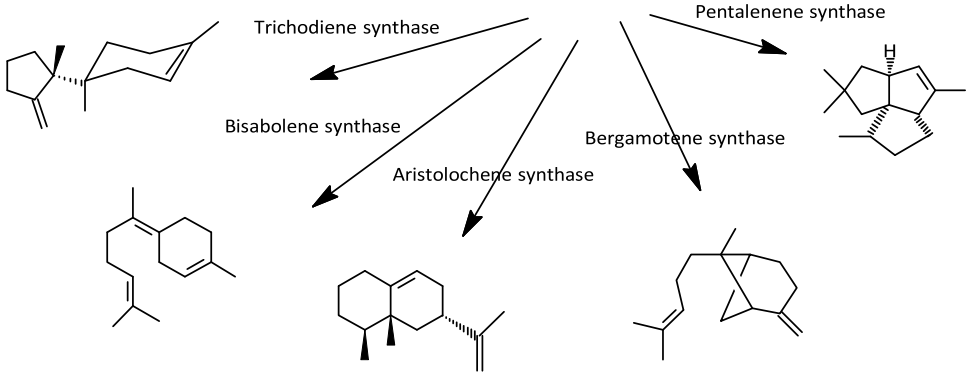
+ Y CO2–

NH3+ NH+3

Figure 4 Pyridoxal phosphate chemistry. (a) Reactions of pyridoxal phosphate. (b) Stereoelectronic control of carbanion formation in pyridoxal phosphate reactions.

Farnesyl diphosphate PP_i

OPP_i



and so on

Figure 5The biosynthesis of sesquiterpenes.

optimally aligned to react with the catalytic residues. In addition, the conformation of the substrate is constrained, which will control the course of the reaction.

Specificity of Enzymes

One of the properties of enzymes that makes them so important as diagnostic and research tools is the specificity they exhibit relative to the reactions they catalyze. A few enzymes exhibit absolute specificity; that is, they will catalyze only one particular reaction. Other enzymes will be specific for a particular type of chemical bond or functional group. In general, there are four distinct types of specificity:

- Absolute specificity - the enzyme will catalyze only one reaction.
- Group specificity - the enzyme will act only on molecules that have specific functional groups, such as amino, phosphate and methyl groups.
- Linkage specificity - the enzyme will act on a particular type of chemical bond regardless of the rest of the molecular structure.
- Stereochemical specificity - the enzyme will act on a particular steric or optical isomer.

Though enzymes exhibit great degrees of specificity, cofactors may serve many apoenzymes. For example, nicotinamide adenine dinucleotide (NAD) is a coenzyme for a great number of dehydrogenase reactions in which it acts as a hydrogen acceptor. Among them are the alcohol dehydrogenase, malate dehydrogenase and lactate dehydrogenase reactions.

5. Explain what you understand by the term ant nutrients.

Ant nutrients are defined as natural or synthetic compounds that inhibit the absorption of nutrients and thus prevent their utilization (Shahidi F, 2009 and Palmer S, 2011,)

Antinutrients that may have practical importance occur mainly in plant foods, especially in the hulls of cereal grains (bran), legumes and tea.

Food processing, such as fermentation, germination, malting, soaking and cooking can greatly reduce the amount of antinutrients in foods * Bohn L et al, 2008, and Hotz Z et al, 2007)

Inhibitors of digestive enzymes, which prevent the digestion and hence absorption of certain nutrients:

- **Phytates** from whole grain cereals and legumes can reduce digestibility of proteins and carbohydrates(Palmer S, 2011 and Dolan LC et al, 2010,)
- **Carb blockers:**
- **Alpha-glucosidase inhibitors** inhibit the digestion of carbohydrates; **acarbose** is used as a glucose-lowering drug in diabetes mellitus

Foods High in Antinutrients

Legumes: Beans, peas and lentils co ntain phytates, oxalates and tannins that can inhibit the absorption of calcium from these foods (Heaney RP et al, 1991, and Odumodu CU et al, 1992,) Calcium from soy is well absorbed, though (Weaver CM et al, 1999,)

Cereal Grains

- **Bran** of cereal grains (whole grain bread, whole oatmeal, brown rice, black, brown and red [finger] millet) contains phytates, oxalates and tannins(Saleh ASM et al, 2013,)

  Brown rice and whole quinoa contain phytates, saponins, lectins and protease inhibitors, while white rice and dehulled quinoa are low in antinutrients(Chauhan GS et al, 1992,). Brown rice, despite its higher nutritional content, has no greater nutritional value than white rice, possibly due to presence of antinutrients (Chauhan GS et al, 1992),

Raw Eggs

The protein avidin in raw eggs inhibits the absorption of biotin (vitamin B7). Avidin is destroyed by cooking. *Available online at www.scholarsresearchlibrary.com Scholars Research Library J. Nat. Prod. Plant Resour., 2011, 1 (2): 56-61 (http://scholarsresearchlibrary.com/archive.html)*

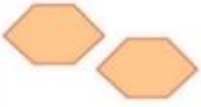
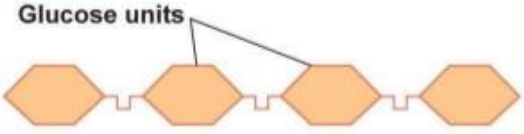
Compounds or substances which act to reduce nutrient intake, digestion, absorption and utilization and may produce other adverse effects are referred to as antinutrients or antinutritional factors. Plant sources contain in their raw state wide varieties of antinutrients which are potentially toxic. The some major antinutrients includes: saponins, phytic acid, protease inhibitors. The proximate and phytochemical composition of Chlorophytum comosum was determined.

b. Explain three functions of bile in the digestion of lipids.

Bile facilitate the hydrolysis of water insoluble tri glyceride molecule to monoglycerides and free fatty acids which then forms water water soluble micelles with bile salts (Hofmann and Borgstrom,1962)

c. Explain how proteins differ structurally from carbohydrates and lipids.

Structural Differences Between Carbohydrates, Lipids, and Proteins

Macronutrients	Chains of	Example
Carbohydrates	Glucose 	Glucose units 
Lipids	Fatty acids 	Triglyceride 
Proteins	Amino acids 	Amino acids 

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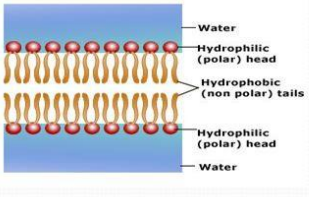
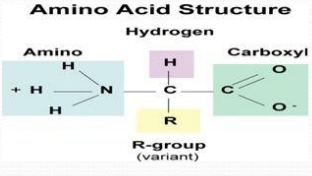
Molecular structures

Carbohydrate

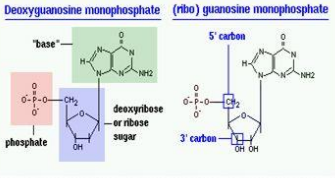
Lipids



Proteins



Nucleic acid



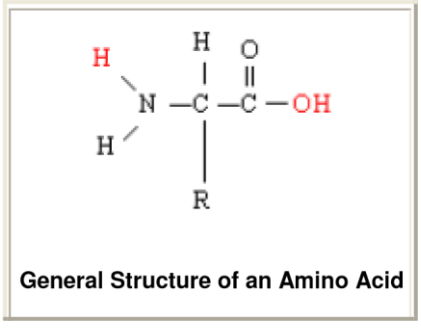
Proteins formed by a linear combination of amino acids monomers (among 20) by peptide linkage
Carbohydrates formed by linear or branched combination of monosaccharides monomers by glycosidic linkage
Lipids form large structures but the interactions are not covalent. Non polar and amphiphatic molecules

Lipids are biological molecules characterized by limited solubility in water and solubility in non-polar organic solvents. Their intermolecular interactions are dominated by the hydrophobic effect and van der Waals interactions. Many lipids are, however, amphipathic molecules, which interact with other molecules and with aqueous solvents via hydrogen bonding and electrostatic interactions.

Importance

Lipids are major components of **cell membranes**, and are responsible for most of the permeability filter functions of membranes. Membranes act as barriers to separate compartments within eukaryotic cells, and to separate all cells from their surroundings.

Proteins

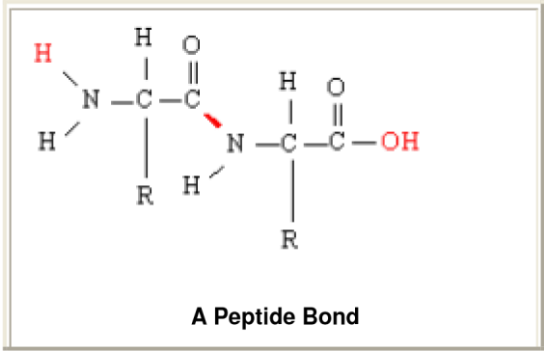


General Structure of an Amino Acid

Proteins are polymers of amino acids. While there are hundreds of thousands of different proteins that exist in nature, they are all made up of different combinations of amino acids. Proteins are large molecules that may consist of hundreds, or even thousands of amino acids. Amino acids all have the general structure:

The R in the diagram represents a functional group that varies depending on the specific amino acid in question. For example, R can be simply an H atom, as in the amino acid glycine, or a more complex organic group. When 2 amino acids bond together, the two ends of nearby amino acids are released and the carbon (called a carboxyl) end of one amino acid bonds to the nitrogen end of the adjacent one forming a peptide bond, as illustrated below right.

When many amino acids bond together to create long chains, the structure is called a protein (it is also called a polypeptide because it contains many peptide bonds).



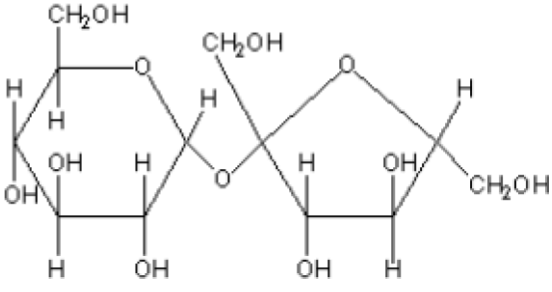
A Peptide Bond

Carbohydrates

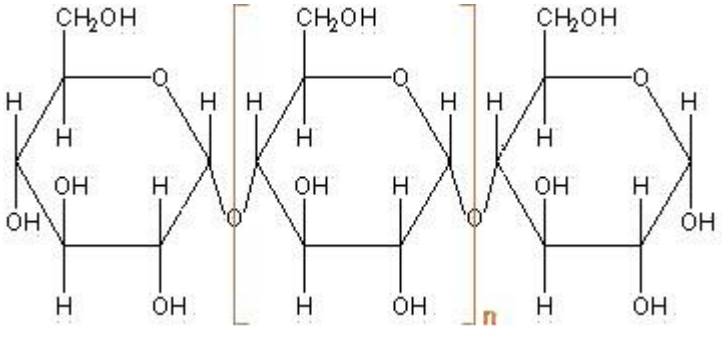
There are two types of carbohydrates, the simple sugars and those carbohydrates that are made of long chains of sugars - the complex carbohydrates.

Simple Sugars: All carbohydrates are made up of units of sugar (also called saccharide units). Carbohydrates that contain only one sugar unit (monosaccharides) or two sugar units (disaccharides) are referred to as simple sugars. Two of the most common monosaccharides are glucose and fructose.

Disaccharides have two sugar units bonded together. For example, common table sugar is sucrose (right), a disaccharide that consists of a glucose unit bonded to a fructose unit.



Complex Carbohydrates: Complex carbohydrates are polymers of the simple sugars. In other words, the complex carbohydrates are long chains of simple sugar units bonded together (for this reason the complex carbohydrates are often referred to as polysaccharides).



Starch (above) is a polymer of the monosaccharide glucose (**n** is the number of repeating glucose units and ranges in the 1,000's). Starches and cellulose are complex carbohydrates used by plants for energy storage and structural integrity.

Glycogen, another polymer of glucose, is the polysaccharide used by animals to store energy. Both starch and glycogen are polymers of glucose, however starch is a long, straight chain of glucose units, whereas glycogen is a branched chain of glucose units.

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