

Assignment No. 3
BIO202 – BIOCHEMISTRY I
Fall 2020

Total Marks: 10

Due date:13/02/2021

Instructions:

Make sure that you upload the solution file before due date. No assignment will be acceptable through e-mail after the due date.

Formatting guidelines

- Use the font style “Times New Roman” and font size “12”.
- Compose your document in MS-Word, any file created in any format will not be accepted and marked zero.
- Use black and blue font colors only.

Solution guidelines

- This is not a group assignment, it is an individual assignment so be careful and avoid copying others' work
- Give the answer according to question only and avoid irrelevant details.

Please note that your assignment will not be graded if:

- It is submitted after due date
- The file you uploaded does not open
- The file you uploaded is copied from someone else
- It is in some format other than .doc
- Cheating or copying of assignment from internet, ppt lessons or from each other is strictly prohibited. The cheated or copied assignment will be marked 'Zero'.
- Answers should be précised and clear, with no useless material.

Assignment questions:

Q1: How two types of” PHOSPHOLIPIDS” are differ chemically and structurally? (2 marks)

Answer:

two major types of phospholipids are:

1. Stearic Acid:

Stearic acid is a long chain saturated fatty acid. It is also called Octadecanoic acid or Stearophanic acid. In its solid form, it appears as a white solid and has a mild pungent oily odor. It floats on water. It functions as a plant metabolite, an algal metabolite, a *Daphnia magna* metabolite, and a human metabolite. It is derived from an octadecane. Stearic acid is used mostly in the manufacture of soaps, detergents, and several other cosmetics such as shaving creams and shampoos. Soaps are not produced directly from this compound, but indirectly via the saponification of stearic acid esters consisting of triglycerides. Stearic acid esters of ethylene glycol, glycol stearate, and glycol distearate are used in shampoos, soaps, and other daily use cosmetics items to achieve a pearly effect.

2. Phosphatidylcholine:

They also constitute the major phospholipid class contained in lipoproteins, biliary lipid aggregates and lung surfactant. As is the case for the other glycerophospholipids, phosphatidylcholines are composed of two fatty acids covalently linked to a glycerol moiety by ester bonds in the sn-1 sn-2 positions. Phosphatidylcholine is a major constituent of cell membranes and pulmonary surfactant, and is more commonly found in the exoplasmic or outer leaflet of a cell membrane. Phosphatidylcholine also plays a role in membrane-mediated cell signaling and PCTP activation of other enzymes.

Q2: Which types of fats are considered as unhealthy fats and why? Also mention why Mediterranean Diet is considered as healthy one? (3 marks)

Answer:

There are two main types of potentially harmful dietary fats:

Saturated fat:

This type of fat comes mainly from animal sources of food, such as red meat, poultry and full-fat dairy products. Saturated fats raise high-density lipoprotein (HDL or "good") cholesterol and low-density lipoprotein (LDL or "bad") cholesterol levels, which may increase your risk of cardiovascular disease.

Trans fat:

This type of fat occurs naturally in some foods in small amounts. But most trans fats are made from oils through a food processing method called partial hydrogenation. These partially hydrogenated trans fats can increase total blood cholesterol, LDL cholesterol and triglyceride levels, but lower HDL cholesterol. This can increase your risk of cardiovascular disease.

Mediterranean Diet:

A typical Mediterranean diet includes lots of vegetables, fruits, beans, cereals and cereal products, for example wholegrain bread, pasta and brown rice. It also contains moderate amounts of fish, white meat and some dairy.

It's the combination of all these elements that seems to bring health benefits, but one of the key aspects is the inclusion of healthy fats. Olive oil, which is a monounsaturated fat, is most commonly associated with the Mediterranean diet, but polyunsaturated fats are also present in nuts, seeds and oily fish.

As research into the benefits of this type of diet is ongoing, there may eventually be certain foods that are found to have greater significance for health. For now, however, it seems it is the overall diet approach and the combination of foods, rather than individual 'superfoods' that make this such a healthy way to eat.

This makes sense, as it's true that if you are eating an unhealthy diet full of processed foods, adding one element such as olive oil is unlikely to have noticeable health benefits if that's the only change you make. However, if you adjust your whole diet so you eat a little less meat and more fish, opt for healthy fats and eat more fruit and vegetables, then it could make a significant difference.

Q3: Make a comprehensive table in which enlist different types of lipoprotein (in the respective columns) also describe different properties, composition, function and biochemical activities of each type. (3 marks)

Answer:

Chylomicrons

Composition: Chylomicrons are composed of a main central lipid core that consists primarily of triglycerides, however like other lipoproteins, they carry esterified cholesterol and phospholipids. The backbone structural protein is the truncated apolipoprotein B-48, which is the main non-exchangeable protein.

Function: Chylomicrons consist of a primary central lipid center consisting mostly of triglycerides, but they bear esterified cholesterol and phospholipids, including other lipoproteins. Truncated apolipoprotein B-48, which is the largest non-exchangeable proteins, is the backbone structural protein.

Properties: Chylomicrons are the largest lipoproteins, with diameters of 75–600 nanometres (nm; 1 nm = 10⁻⁹ metre). They have the lowest protein-to-lipid ratio (being about 90 percent lipid) and therefore the lowest density.

Biochemical Activities: Chylomicrons transport lipids absorbed from the intestine to adipose, cardiac, and skeletal muscle tissue, where their triglyceride components are hydrolyzed by the activity of the lipoprotein lipase, allowing the released free fatty acids to be absorbed by the tissues.

Low-Density Lipoproteins (LDL)

Composition: These particles are produced by the liver and are triglyceride rich. They contain apolipoprotein B-100, C-I, C-II, C-III, and E. Apo B-100 is the core structural protein and each VLDL particle contains one Apo B-100 molecule.

Function: Very-low-density lipoproteins transport endogenous triglycerides, phospholipids, cholesterol, and cholesteryl esters. It functions as the body's internal transport mechanism for lipids. In addition it serves for long-range transport of hydrophobic intercellular messengers, like the morphogen Indian hedgehog (protein).

Properties: VLDL is assembled in the liver from triglycerides, cholesterol, and apolipoproteins. VLDL is converted in the bloodstream to low-density lipoprotein (LDL) and intermediate-density lipoprotein (IDL). VLDL particles have a diameter of 30-80nm.

Biochemical Activities: VLDL are sometimes called “bad” cholesterol because they can contribute to the buildup of plaque in your arteries.

High-Density Lipoproteins (HDL)

Composition: For close to four decades, we have known that high density lipoprotein (HDL) levels are inversely correlated with the risk of CVD. HDL is a complex particle that consists of proteins, phospholipids, and cholesterol and has the ability to carry microRNAs.

Functions: HDL (high-density lipoprotein), or “good” cholesterol, absorbs cholesterol and carries it back to the liver. The liver then flushes it from the body. High levels of HDL cholesterol can lower your risk for heart disease and stroke.

Properties: In addition to their well-known ability to promote the efflux of cholesterol from foam cells, HDLs have antioxidant and anti-inflammatory effects that may contribute to their antiatherogenic potential. HDLs inhibit the pro-atherogenic oxidative modification of LDL.

Biochemical Activities: From a mechanistic perspective, HDL classically function in reverse cholesterol transport (RCT), removing cholesterol from peripheral tissues and cells such as macrophages and delivering it to the liver and to steroidogenic organs by binding of the major HDL apolipoprotein, apolipoprotein A-I (apoA-1).

Q4:What mechanism lies behind the reduction of surface tension in alveoli of lungs (2 marks)

Answer:

Pulmonary surfactant is a mixture of lipids and proteins which is secreted by the epithelial type II cells into the alveolar space. Its main function is to reduce the surface tension at the air/liquid interface in the lung. This is achieved by forming a surface film that consists of a monolayer which is highly enriched in dipalmitoylphosphatidylcholine and bilayer lipid/protein structures closely attached to it. The molecular mechanisms of film formation and of film adaptation to surface changes during breathing in order to remain a low surface tension at the interface, are unknown. The results of several model systems give indications for the role of the surfactant proteins and lipids in these processes. In this review, we describe and compare the model systems that are used for this purpose and the progress that has been made. Despite some conflicting results using different techniques, we conclude that surfactant protein B (SP-B) plays the major role in

adsorption of new material into the interface during inspiration. SP-C's main functions are to exclude non-DPPC lipids from the interface during expiration and to attach the bilayer structures to the lipid monolayer. Surfactant protein A (SP-A) appears to promote most of SP-B's functions. We describe a model proposing that SP-A and SP-B create DPPC enriched domains which can readily be adsorbed to create a DPPC-rich monolayer at the interface. Further enrichment in DPPC is achieved by selective desorption of non-DPPC lipids during repetitive breathing cycles.