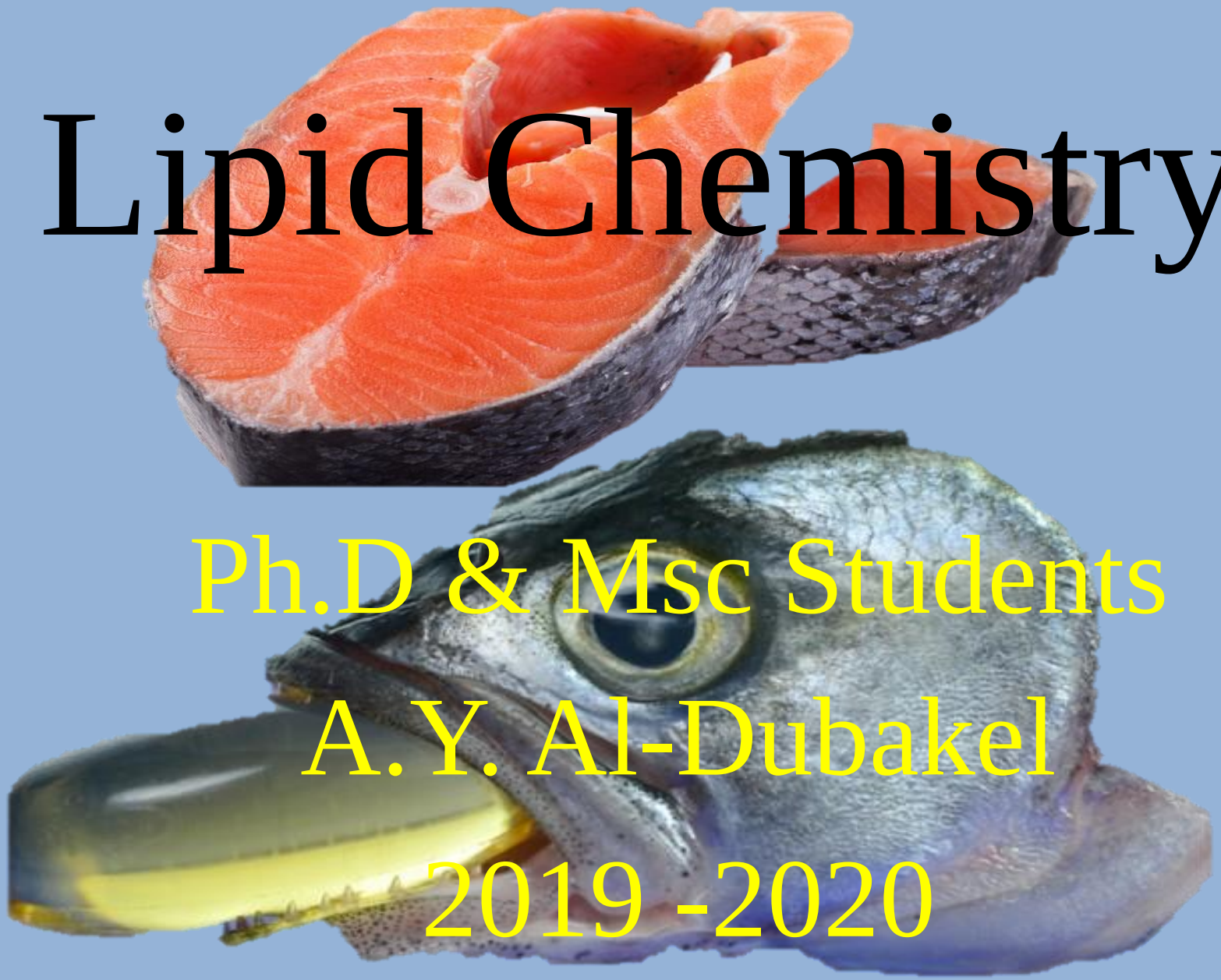
Lipid Chemistry



Ph.D & Msc Students

A. Y. Al-Dubakel

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Lecture 1

Refs.
1)https://www.lipidhome.co.uk/lipids/simple/lipoprot/index.htm
2)https://www.news-medical.net/life-sciences/Lipoprotein-Classification.aspx
3)https://www.britannica.com/science/lipoprotein

Lipid

The lipids are heterogenous group of compounds related to the fatty acids. They are insoluble in water and soluble in other solvents such as ether, chloroform and benzene. Chemically they are esters of fatty acid and some alcohols. The lipids are widely distributed in plant and animal kingdom. The lipids include fats, oils, waxes and related compounds. Oils are liquid at 20° C and are solids at 20° C

Properties of fat

(a) Insoluble in water, but readily soluble in ether, chloroform, benzene, carbon tetra chloride

(b) Soluble in hot alcohol but slightly soluble in cold.

(c) Good solvents for other fats, fatty acids etc.

(d) Colourless, odourless, tasteless and neutral in reaction.

(e) Several neutral fats are readily crystallised, e.g. mutton, beef

(f) Their melting points are low.

(g)The specific gravity is about 0.86. Hence the fat readily float in water.

(h)They spread uniformly over the surface of waters and this spreading effect is to lower surface tension.

Occurrence of fat

- Widely distributed in plants and animals.
- Plants: nuts, seeds and oils.
- The Nervous system of Animals: cholesterol, phospholipids and glycolipids.
  - Subcutaneous tissues, mesenteric tissues, fatty tissues around the kidney, yellow bone marrow
- Blood: contains lipoproteins

Functions of lipid

1**) Source of energy**: Lipids are important sources of metabolic energy (ATP). Lipids are the most energy rich of all classes of nutrients: gross energy value of lipid is 9.5 Kcal/g, protein 5.6 Kcal/g, carbohydrate 4.1 Kcal/g and the net values were 9 Kcal /g, 4.0 Kcal/g and 4.0 Kcal/g for fat, protein and carbohydrate respectively. The free fatty acids derived from triglycerides (fats and oils) are the major aerobic fuel sources for energy metabolism.

2)**Forms part of membrane**: Lipids are essential components of all cellular and subcellular membranes (Lipid classes that are involved include phospholipids, and sterol esters).

3) **Source of fat soluble vitamins**: Lipids serve as biological carriers for the absorption of the fat soluble vitamins A, D, E and K.

Functions of lipid

4) **Source of essential fatty acids**: Lipids are a source of essential fatty acids. Linoleic and linolenic acids are essential for the maintenance and integrity of cellular membranes.
5) **Mechanical cushion/support**: Lipids play a role as mechanical cushion/support for the vital body organs.
6) **Source of essential steroids**: Lipids are a source of essential steroids, which in turn perform a wide range of important biological functions. The sterol cholesterol is involved in the maintenance of membrane systems, for lipid transport, and as a precursor of vitamin D3, the bile acids, and the steroid hormones – androgens, estrogens, adrenal hormones, and corticosteroids.

Functions of lipid

7) **Contribute food flavor, taste and texture**: Fat play a role in food flavor / mouth feel, palatability, texture and aroma.

8) Provide shape and contour to the body.

9) Act as metabolic regulators.

10) Combinations of lipid and protein (lipoproteins) are important cellular constituents, occurring both in the cell membrane and in the mitochondria, and serving also as the means of transporting lipids in the blood.

Lipoprotein

Lipoproteins are special particles made up of droplets of fats surrounded by a single layer of phospholipid molecules, which means they have both polar and non-polar ends.

In a lipoprotein, the polar ends of all the phospholipid molecules face outwards, so as to interact with water, itself a polar molecule. This enables the lipoprotein to be carried in the blood rather than rising to the top, like cream on milk.

The non-polar fat balled up inside the phospholipid layer, at the center of the lipoprotein, is thus transported to the place where it must be stored or metabolized, through the bloodstream, despite being insoluble in blood. Thus lipoproteins are molecular level trucks to carry fats wherever they are required or stored.