CHEMISTRY 2

Biochemistry

Lipids Lec. 2

Course prof.

Dr. Ahmed Mohamed

Lecturer at Dep. Of Biochemistry

A-Phospholipids

Definition: Phospholipids or phosphatides are compound lipids, which contain phosphoric acid group in their structure.

Sources: They are found in all cells (plant and animal), milk and egg-yolk in the form of lecithins.

Structure: phospholipids are composed of:

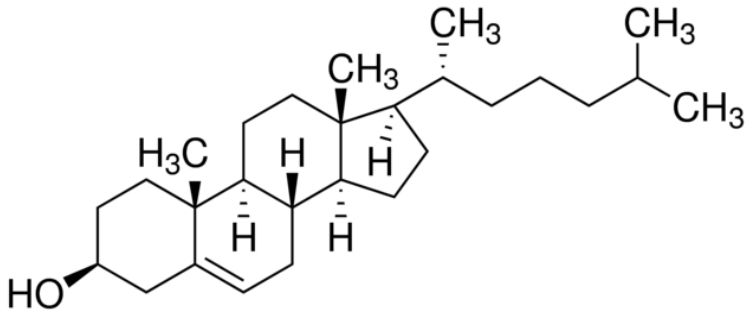
Fatty acids (a saturated and an unsaturated fatty acid).

1. **Nitrogenous base** (choline, serine, threonine, or ethanolamine).
2. **Phosphoric acid.**
3. **Fatty alcohols** (glycerol, inositol or sphingosine).

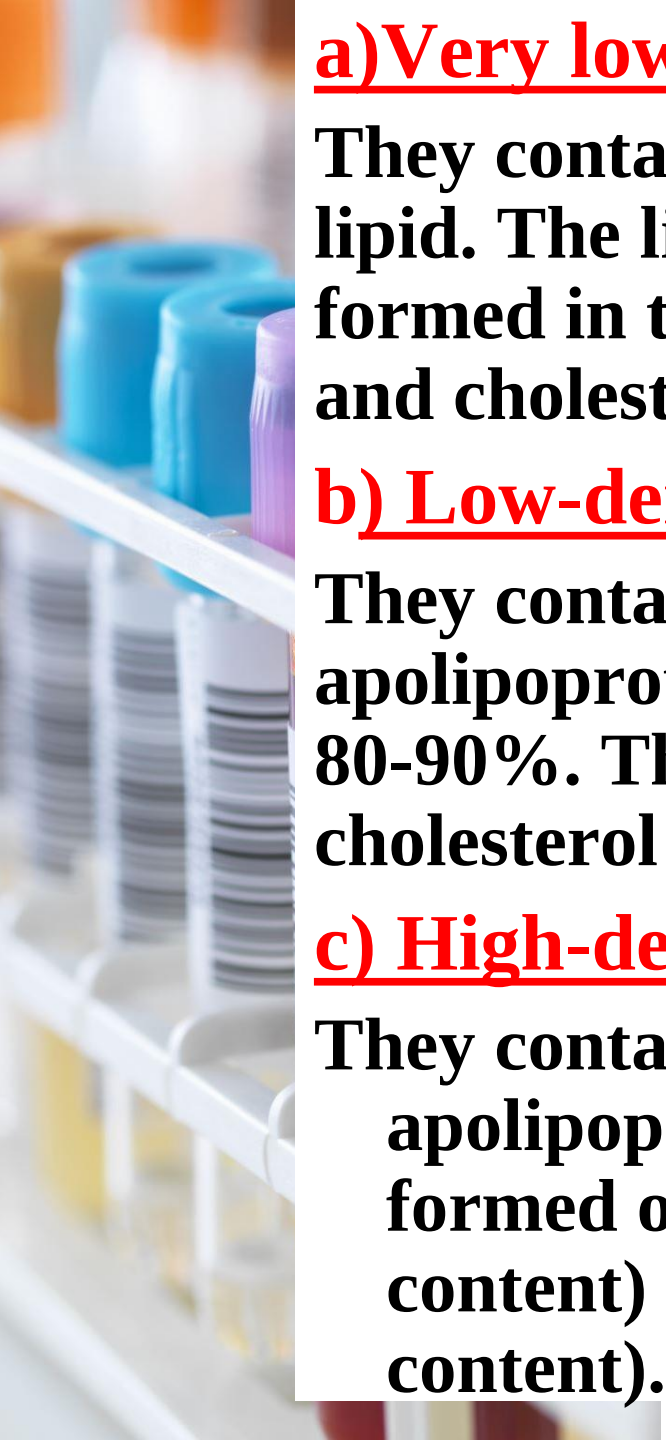
B-Lipoproteins

- **Definition**: Lipoproteins are lipids combined with proteins in the tissues. The lipid component is phospholipid, cholesterol or triglycerides. The holding bonds are secondary bonds.
- They include:
- **Structural lipoproteins**:
- These are widely distributed in tissues being present in cellular and subcellular membranes. In lung tissues and In the eye.
- **Transport lipoproteins**:
- These are the forms present in blood plasma. They are composed of a protein called apolipoprotein and different types of lipids. (Cholesterol, cholesterol esters, phospholipids and triglycerides). As the lipid content increases, the density of plasma lipoproteins decreases.

CHOLESTEROL AND ITS IMPORTANCE



- **It is an important component of cell membranes.**
- **The basis for the synthesis of other steroids, including the sex hormones estradiol and testosterone, as well as other steroids such as cortisone and vitamin D.**
- **Without cholesterol the cell membrane would be too fluid.**



a)Very low-density lipoproteins (VLDL):

They contain about 7-10% protein and 90-93% lipid. The lipid content is mainly triglycerides formed in the liver. They contain phospholipid and cholesterol

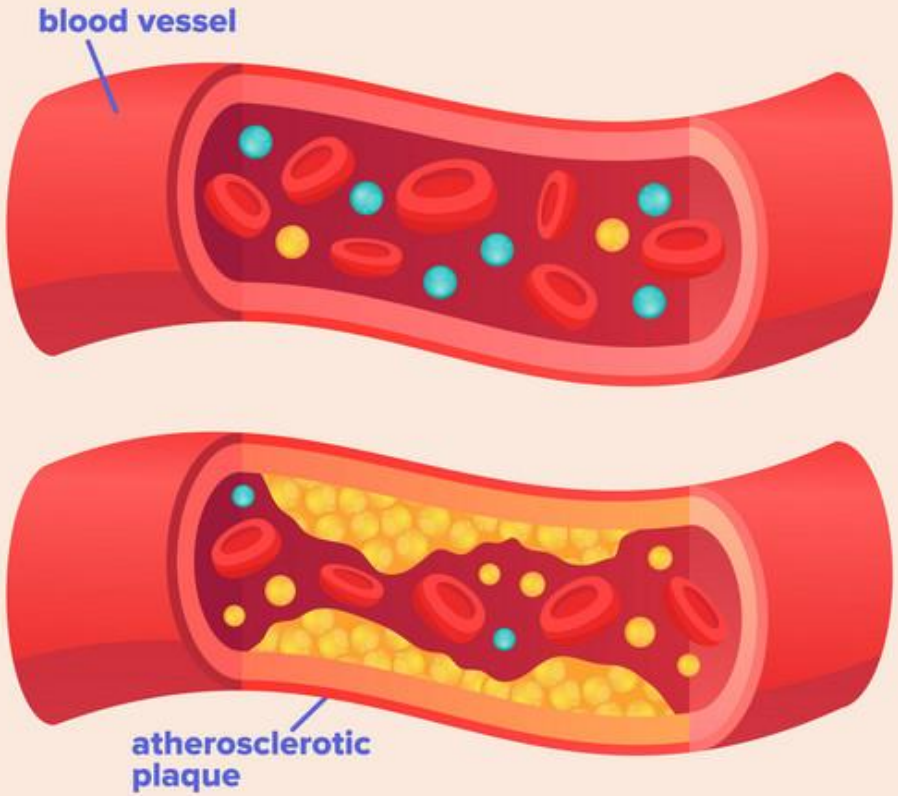
b) Low-density lipoproteins (LDL):

They contain 10-20% proteins in the form of apolipoprotein. Their lipid content varies from 80-90%. They contain about 60% of total blood cholesterol and 40% of total blood phospholipids.

c) High-density lipoproteins (HDL):

They contain 35-55% proteins in the form of apolipoprotein. They contain 45-65% lipids formed of cholesterol (40% of total blood content) and phospholipids (60% of total blood content).

Types of CHOLESTEROL



HDL

High-density lipoprotein

Good cholesterol

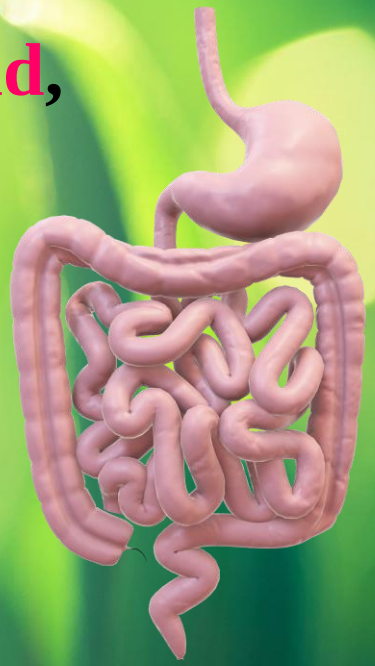
LDL

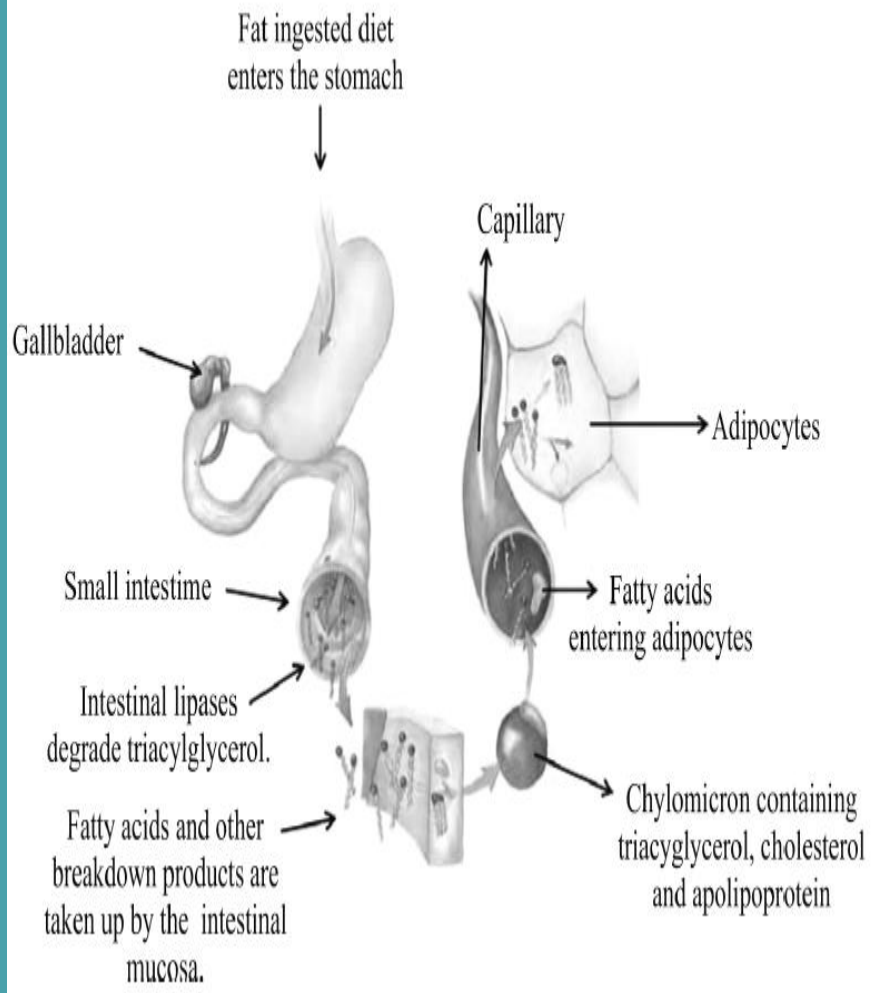
Low-density lipoprotein

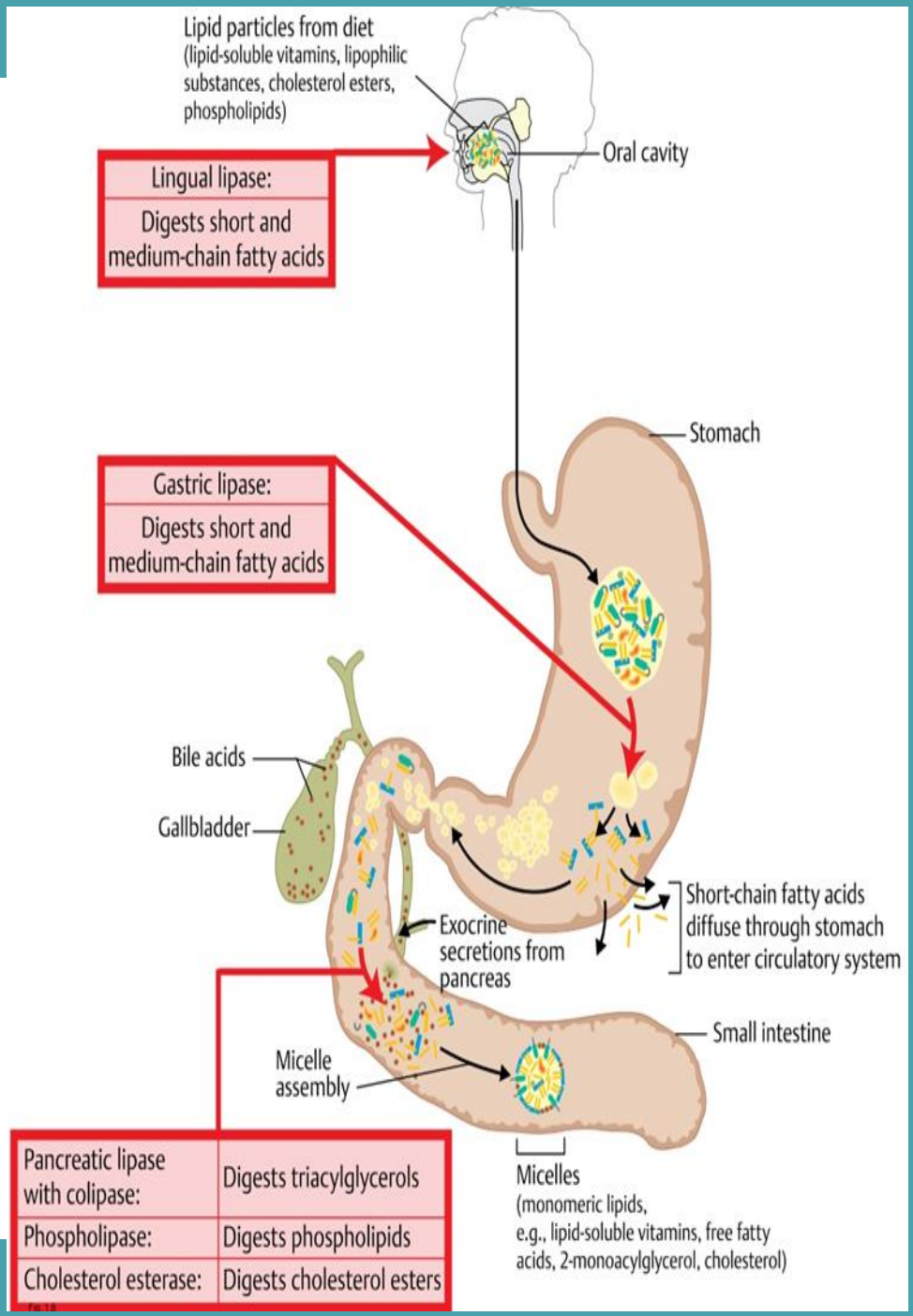
Bad cholesterol

DIGESTION AND ABSORPTION OF LIPIDS

- **Hydrolysis of triacylglycerols:**
- **Gastric lipases that attack the sn-3 ester bond, forming 1,2-diacylglycerols and free fatty acids, aiding emulsification.**
- **Pancreatic lipase is specific for the primary ester links – ie, positions 1 and 3 in triacylglycerols – resulting in 2-monoacylglycerols and free fatty acids.**
- **Bile salts enable emulsification of the products of lipid digestion into micelles and liposomes together with phospholipids and cholesterol.**




Fat ingested diet enters the stomach
Capillary
Gallbladder
Adipocytes
Small intestime
Fatty acids entering adipocytes
Intestinal lipases degrade triacylglycerol.
Fatty acids and other breakdown products are taken up by the intestinal mucosa.
Chylomicron containing triacyglycerol, cholesterol and apolipoprotein


Lipid particles from diet (lipid-soluble vitamins, lipophilic substances, cholesterol esters, phospholipids)
Oral cavity
Lingual lipase: Digests short and medium-chain fatty acids
Stomach
Gastric lipase: Digests short and medium-chain fatty acids
Bile acids
Gallbladder
Short-chain fatty acids diffuse through stomach to enter circulatory system
Exocrine secretions from pancreas
Small intestine
Micelle assembly
Micelles (monomeric lipids, e.g., lipid-soluble vitamins, free fatty acids, 2-monoacylglycerol, cholesterol)
Pancreatic lipase with colipase: Digests triacylglycerols
Phospholipase: Digests phospholipids
Cholesterol esterase: Digests cholesterol esters

Lipoprotein	Source	Main lipid components	Apolipoproteins
Chylomicrons	Intestine	Triacyglycerol	A-I, A-II, A-IV, B 48, C-I, C-II, C-III,E
Chylomicron remnants	Chylomicrons	Triacylglycerol, phospholipids, cholesterol	B-48, E
VLDL	Liver (intestine)	Triacylglycerol	B-100, C-I, C-II, C-III
IDL	VLDL	Triacylglycerol, cholesterol	B-100, E
LDL	VLDL	Cholesterol	B-100
HDL	Liver, intestine, VLDL, chylomicrons	Phospholipids, cholesterol	A-I, A-II, A-IV, C-I, C-II, C-III, D, E

References:

- https://www.google.com/search?q=cholesterol&source=lnms&tbm=isch&sa=X&ved=2ahUKEwiaq-_73 5L0AhXUasAKHTutCPgQ_AUoAXoECAEQAw&biw=1=rpd&657=hib&1366
- https://nios.ac.in/media/documents/dmlt/Biochemistry/Lesson-05.pdf
- https://www.google.com/search?q=digestion+and+absorption+of+lipids&source=lnms&tbm=isch&sa=X&ved=2ahUKEwj09a3BhpP0AhXNRPEDHb1BCsgQ_AUoAXoECAEQAw&biw=1366&bih=657&dpr=1

For communication:

ahmed.mohamed@fagr.bu.edu.eg

https://bu.edu.eg/portal/index.php?act=46&username=ahmedmohamed6