

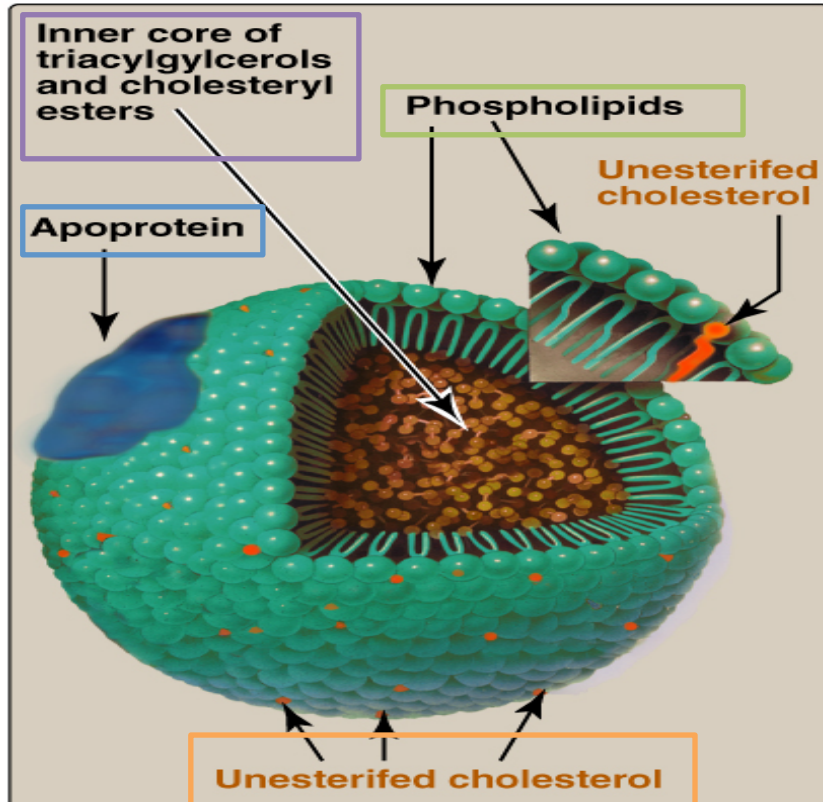
Lipoprotein

CVS block
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Always remember: lipids are water-*insoluble*, Blood is mainly composed of water. So you need carrier for lipid inside the circulation. And the carrier is **LIPOPROTEIN**

STRUCTURE OF LIPOPROTEIN



CORE: Lipid (triacylglycerols & cholesteryl esters)

SHELL:

- **apolipoprotein:** (Also called apoproteins) It has functions of
 1. providing recognition site (ligand)
 2. serving as activator or coenzymes for enzyme involved in lipoprotein metabolism
 3. transport and structure
- Phospholipid
- Non-esterase cholestrols

Atherosclerosis
and hypertension

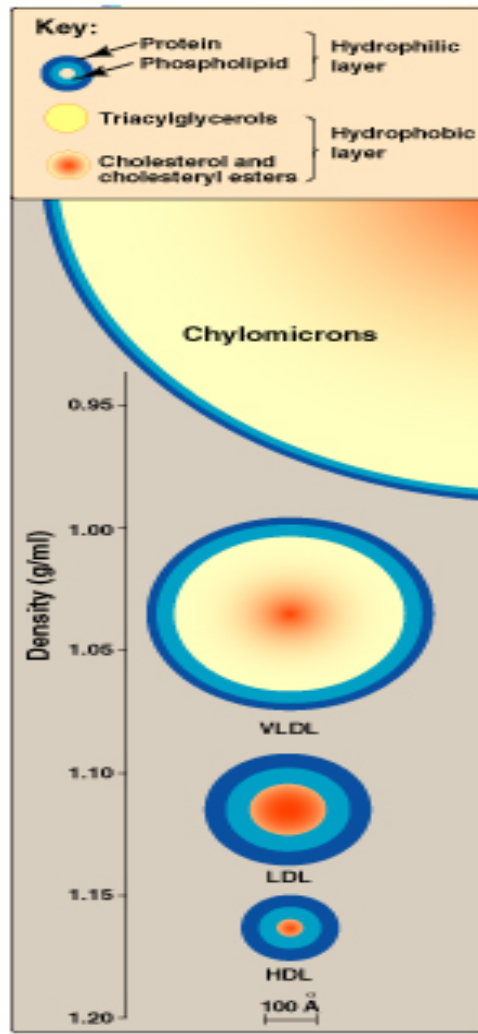
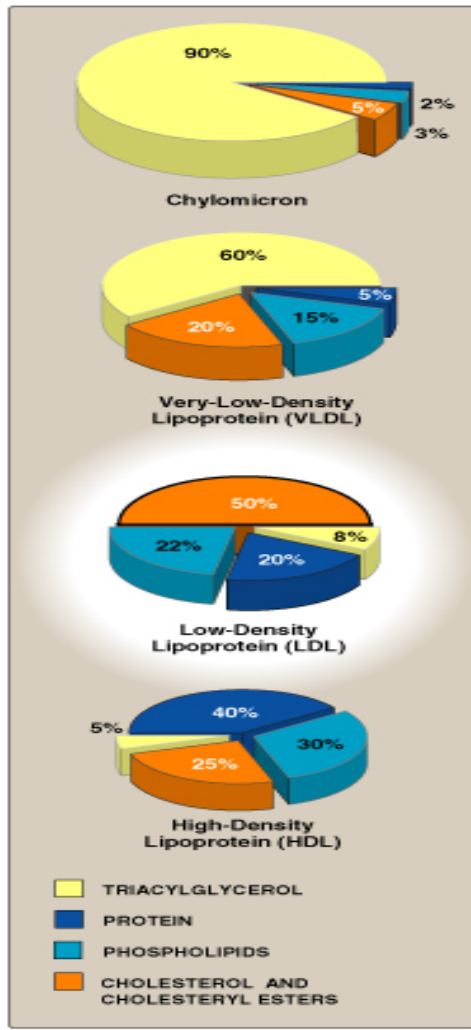
Coronary heart
diseases

Lipoproteins and
Related Clinical
Problems

Lipoproteinemias
(hypo- and hyper-)

Fatty liver

TYPES OF LIPOPROTEIN



Additional note: the more lipids the less density, the more protein the more density.

	Density	Size	Contents	Electrophoretic mobility* (in order)
Chylomicron	Lowest	Largest	High lipid (TG*) & Low protein	4
VLDL	More than chylomicron	Smaller than chylomicron	less lipid (TG*) & more protein	2
LDL	More	smaller	Less Lipid & More protein	3
HDL	Highest	smallest	Low lipid & High protein	1

- 1) TG = triacylglycerol
- 2) CH = cholesterol
- 3) Electrophoretic depends on size & charge

- HDL has the most concentration of protein
- Chylomicron has the most concentration of TG
- LDL has the most concentration of CH.

LIPOPROTEIN IN BLOOD

- For triacylglycerol transport (used TG-rich molecules):
 - Chylomicron: used for transport in Triacylglycerol dietary.
 - VLDL: used for transport of endogenous TG (synthesized in liver)
- For cholesterol transport (cholesterol-rich):
 - LDL: Free cholesterol (unesterified)
 - HDL: esterified cholesterol

CHYLOMICRONS

- Assembled in intestinal mucosal cells
- Lowest density
- Largest size
- Highest % of lipids and lowest % proteins
- Highest triacylglycerol (dietary origin)
- Carry dietary lipids to peripheral tissues
- Responsible for physiological milky appearance of plasma (up to 2 hours after meal)

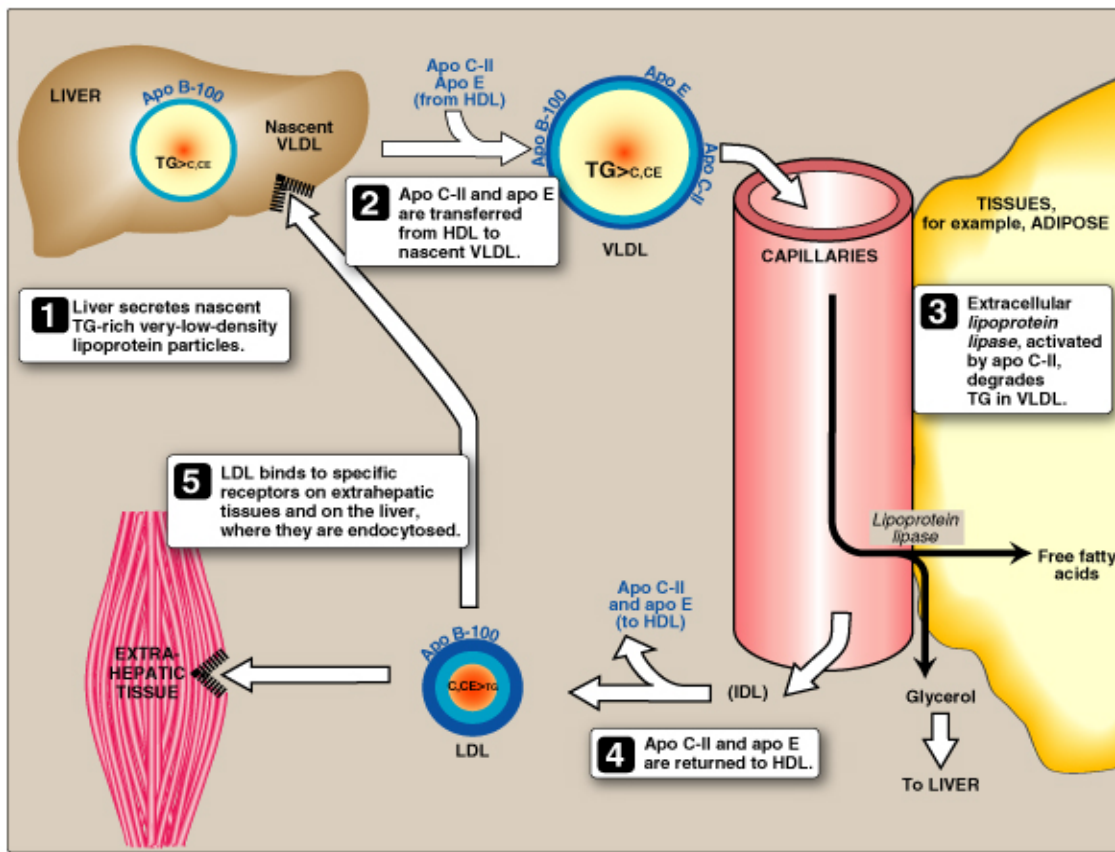
VLDL

- Assembled in liver
- High triacylglycerol (hepatic origin)
- Carry lipids from liver to peripheral tissues
- Nascent (not mature) VLDL: contains Apo B-100
- Mature VLDL: Apo B-100 plus, Apo C-II and Apo E (Apo E and Apo C-II are donated from HDL)

METABOLISM OF VLDL

- Assembled and secreted as nascent form from liver to circulation.
- Mature VLDLs in blood.
- **Mature VLDL** contain:
 - Apo B-100 (Ligand for binding of TG in liver)
 - Apo C-II: is required for activation of lipoprotein lipase.
 - Apo E: is a ligand for IDL.
- **Modifications** of circulating VLDLs: TG is degenerated by lipoproteinase into glycerol and fatty acid (see step 3 in next image + will be discussed)
- End products: IDL₁ then LDL
- Related diseases:
 - **Hypolipoproteinemia:** Abetalipoproteinemia
 - **Hyperlipoproteinemias:**
 - Type I hyperlipoproteinemia
 - Familial type III hyperlipoproteinemia

₁: Intermediate-density lipoprotein.



Modifications of Circulating VLDLs

- As TG is degraded, VLDLs become Smaller in size, More dense and Apo C back to HDL
- Exchange of TG with cholesterol ester (HDL) is done by **cholesterol ester transfer protein**
- Production of LDL in plasma (step 4 in previous image):
 - 1- VLDL is prodced as: IDL.
 - 2- IDL returns Apo E to HDL.
 - 3- LDL is produced.

VLDL-RELATED DISEASES

Hyperlipoproteinemia

Type I Hyperlipoproteinemia

Familial Lipoprotein lipase deficiency
 Due to deficiency of lipoprotein lipase or its cofactor (Apo C-II)
 Shows a dramatic accumulation (≥ 1000 mg/dl) of chylomicrons in plasma
 Usually associated with acute abdomen due to acute pancreatitis
 plasma TG even in the fasted state

Type III Hyperlipoproteinemia

Familial dysbetalipoproteinemia or Apo E deficiency
 Hypercholesterolemia and atherosclerosis

Hypolipoproteinemia

Abetalipoproteinemia:

Defect in TG-transfer protein Apo B-100 cannot be loaded with lipid results accumulation of TG in liver

Fatty Liver (hepatic steatosis)

Imbalance between hepatic synthesis of TG and secretion of VLDLs. results accumulation of TG in liver

MCQS

1) a patient fasting for 10 hours, when the technician took a blood sample he found milky appearance for plasma. What do you think this patient have?

- a) Type III hyperlipoproteinemia
- b) Type II hyperproteinemia
- C) Hypolipoproteinemia
- D) Chylomicrons clearance problem (Type I Hyperlipoproteinemia)

2) the main function of the protein part in lipoprotein is:

- A-Structural and transport function
- B-enzymatic function
- C-ligands for receptor
- D- All above

3) cholesterol is formed of:

- A- cholesterol + H
- B- cholesterol + nitrogen
- C- cholesterol + fatty acid
- D- cholesterol + TG

4) which one of the following lipoproteins has the lowest density:

- A- VLDL
- B- LDL
- C- Chylomicrons
- D- HDL

5) accumulation of TG in the liver will cause :

- A- liver cirrhosis
- B- Fatty liver (Hepatic steatosis)
- C- Liver ischemia
- D- Hepatic failure

6) APO CII and APO E (that are responsible for the maturation of VLDL) come from:

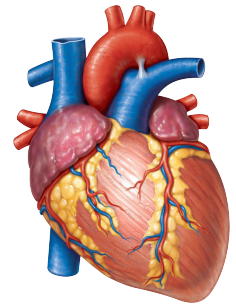
- A- LDL
- B- HDL
- C- Liver
- D- Chylomicron

7) cholesterol ester transfer protein is:

- A- APO CII
- B- APO E
- C- APO B 100
- D- APO D

Answers: 1-D 2-D 3-C 4-C 5-B 6-B 7-D

Good luck



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