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Lipoproteins

Chylomicrons,VLDL, LDL and HDL

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Objects

Lipoprotein structure

Function

Classification

Chylomicrons

VLDL

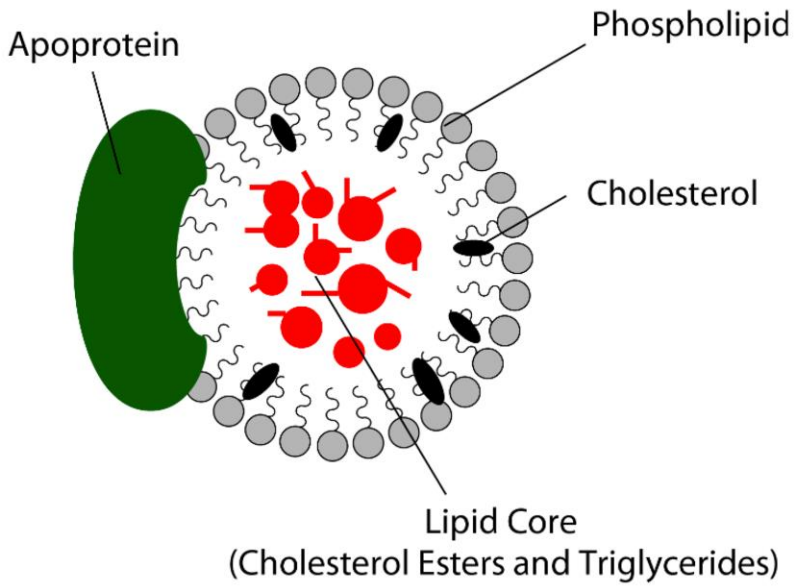
LDL

HDL

Lipoprotein Structure:

Lipoproteins are complex particles that have a central **hydrophobic core** of non-polar lipids, primarily cholesterol esters and triglycerides.

Nonpolar lipid core surrounded by a single surface layer of amphipathic phospholipid and cholesterol molecules.



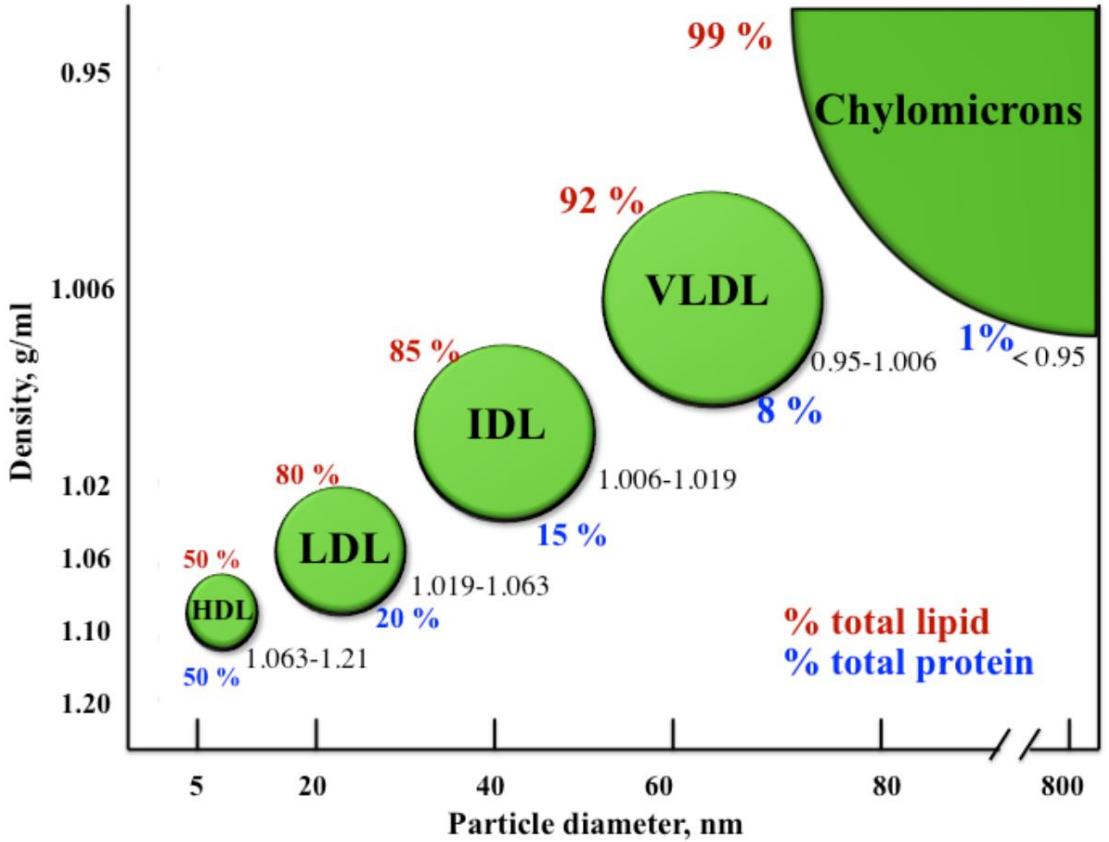
Classification of Lipoprotein:

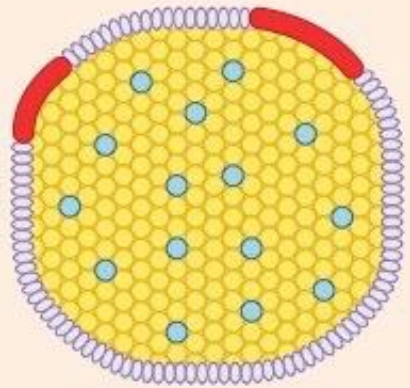
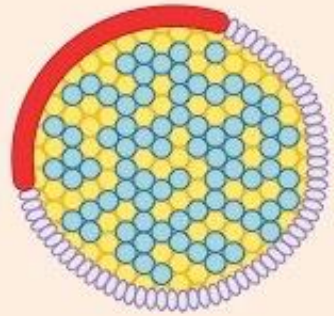
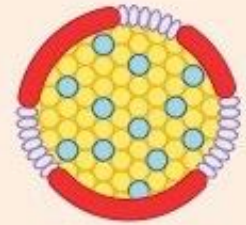
1. Classification of Lipoprotein according to their density.
2. Classification of Lipoprotein base on nature of Apo-protein content

Classification base on Density:

- Lipoproteins can be classified according to their density by using ultracentrifuge to five main different group:

1. Chylomicrons
2. Very low density Lipoprotein
3. Intermediate Density Lipoprotein
4. Low density lipoprotein
5. High density lipoprotein



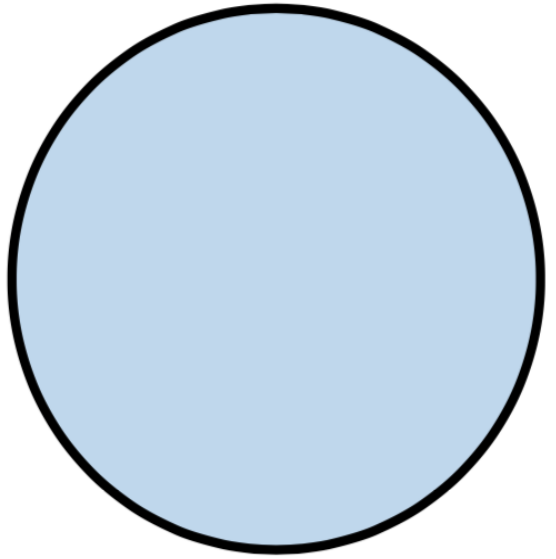
	Chylomicron	LDL	HDL
Diagram Triacylglycerol Cholesterol Phospholipid Apoprotein			
% Lipid			
• Triglyceride	**98**	15	10
• Cholesterol	~1	**60**	30
• Phospholipid	~1	25	60
% Protein			
	2	20	**50**

Function of Lipoprotein:

- **lipoproteins** play a key role in the absorption and transport of dietary lipids by the small intestine, in the transport of lipids from the liver to peripheral tissues, and the transport of lipids from peripheral tissues to the liver and intestine (reverse cholesterol transport)

Chylomicrons:

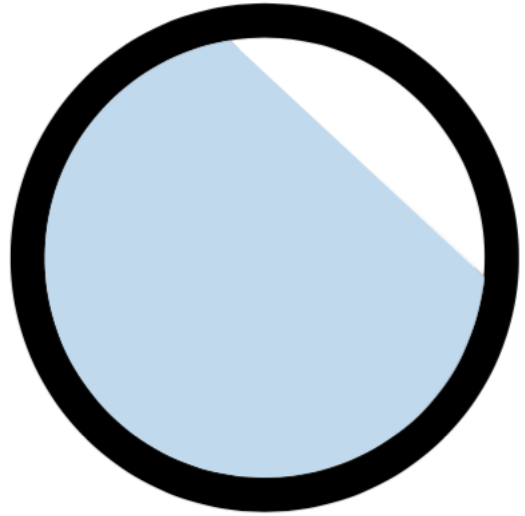
- Chylomicrons are synthesized in the small intestine.
- **Function**:
  - Transport of dietary triglyceride from the intestine. The triglyceride is derived to adipose tissue where it is stored as fat and to muscle cells where it is used as an energy source,



Apoprotein 2%
Triglycerides 90%
Cholesterol 5%
Other lipids 3%

Very Low Density Lipoprotein

- VLDL synthesized in the liver.
- Its function to transport triglycerides synthesized in the liver to adipose and/or muscle cells.
- VLDL is a precursors of the LDLs.



Apoprotein 10%
Triglycerides 60%
Cholesterol 15%
Other lipids 15%

VLDL Value:

- To estimate **VLDL-**C, divide the triglyceride value by 5 if the value is in mg/dL or divide by 2.2 if the value is in mmol/L. In most cases, this formula provides a good estimate of **VLDL-**C.

$$\text{VLDL} = \text{Tg(in mg/dl)} / 5$$
$$= \text{Tg (in mmol/l)} / 2.2$$

Chylomicrons Vs VLDL

Chylomicrons

Chylomicrons synthesized in the small intestine form the absorbed Triglyceride.

Function: chylomicrons is responsible for transporting absorbed triglycerides from the intestine to the skeletal muscles, adipose tissue and liver. Thus, chylomicrons transports exogenous products.

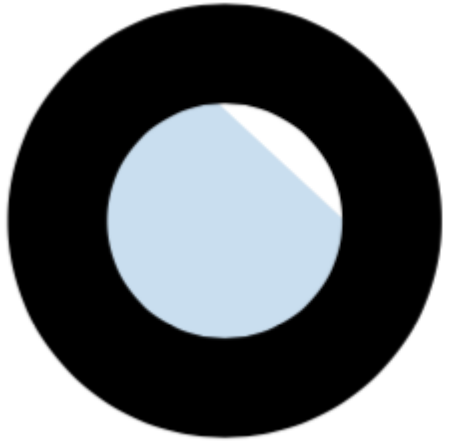
VLDL

VLDL is synthesized in the liver cells.

Function: VLDL transports newly-synthesized triglycerides from the liver to the adipose tissue. Thus, VLDL transports endogenous products.

Low Density Lipoproteins:

- LDLs are what remains of VLDLs when triglycerides have been delivered to adipose and muscle cells.
- They are the primary carriers of non- dietary cholesterol (cholesterol made in the body) to all the tissues.
- Around 70% of cholesterol in blood is present in LDL.



Apoprotein 25%
Triglycerides 10%
Cholesterol 55%
Other lipids 10%

LDL Value

- The traditional **Friedewald equation** estimates **LDL** cholesterol this way: total cholesterol minus HDL cholesterol minus triglycerides divided by five.

- **LDL=T. Cholesterol- HDL cholesterol –TG/5**

High Density Lipoproteins:

- HDLs are synthesized in the liver. When they are released to the bloodstream they are composed almost entirely of apoprotein but acquire cholesterol as they circulated around the body.

- **Function:** transport of excess cholesterol from all non-liver cells back to the liver for excretion.

- Around 30% of cholesterol in blood is present in HDLs.

Apoprotein 50%
Triglycerides 3%
Cholesterol 20%
Other lipids 25%

Total cholesterol Test

Normal Findings

- Adult/elderly: <200 mg/dL or <5.20 mmol/L (SI units)
- Child: 120-200 mg/dL Infant: 70-175 mg/dL
- Newborn: 53-135 mg/dL

Indications

- Cholesterol testing is used to determine the risk for coronary heart disease (CHD).
- It is also used for evaluation of hyperlipidemias.

Test Explanation

- Cholesterol is the main lipid associated with arteriosclerotic vascular disease(the thickening and hardening of the walls of the arteries).
- Cholesterol, however, is required for the production of steroids, sex hormones, bile acids, and cellular membranes.
- Most of the cholesterol we eat comes from foods of animal origin. The liver metabolizes the cholesterol to its free form, and cholesterol is transported in the bloodstream by lipoproteins.
- Nearly 75% of the cholesterol is bound to low-density lipoproteins (LDL), and 25% is bound to high-density lipoproteins (HDLs). Cholesterol is the main component of LDL and only a minimal component of HDL and very-low-density lipoprotein (VLDL).

- It is the LDL that is most directly associated with increased risk for CHD. The purpose of cholesterol testing is to identify patients at risk for arteriosclerotic heart disease (AHD).
- Cholesterol testing is usually done as a part of a lipid profile, which evaluates lipoproteins and triglycerides, because, by itself, cholesterol is not a totally accurate predictor of heart disease.

- There is considerable variation in cholesterol levels. Day-to-day cholesterol values in the same individual can vary by 15%. An 8% difference can even be identified within the same day. Positional changes can affect these levels. Levels can **decrease** by as much as 15% in the recumbent position.

Interfering Factors

- Pregnancy
- Oophorectomy(ovary remover) and postmenopausal
- Recumbent position is associated with decreased levels.
- Drugs that may cause **increased** levels include adrenocorticotropic hormone, anabolic steroids, beta-adrenergic blocking agents, corticosteroids, cyclosporine, epinephrine, oral contraceptives, phenytoin (Dilantin), sulfonamides, thiazide diuretics, and vitamin D.
- Drugs that may cause **decreased** levels include allopurinol, androgens, bile salt-binding agents, captopril, chlorpropamide, clofibrate, colchicine, colestipol, erythromycin, isoniazid, liothyronine (Cytomel), monoamine oxidase inhibitors, niacin, nitrates, and statins.

Increased Levels

- Familial hyperlipidemia: Enzymatic deficiencies in lipid metabolism are associated with elevated cholesterol. Increased cholesterol levels are associated with
  - hypothyroidism, uncontrolled diabetes mellitus, pregnancy, high-cholesterol diet, hypertension, myocardial infarction (MI), atherosclerosis, biliary cirrhosis, stress, and nephrotic syndrome.

Decreased Levels

- Malabsorption, Malnutrition, Advanced cancer
- hyperthyroidism, cholesterol lowering medication, hemolytic anemia, sepsis/stress, and liver disease.