

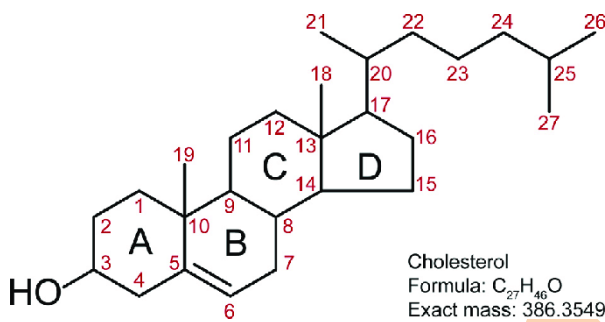
Cholesterol and Lipoproteins

1. Cholesterol

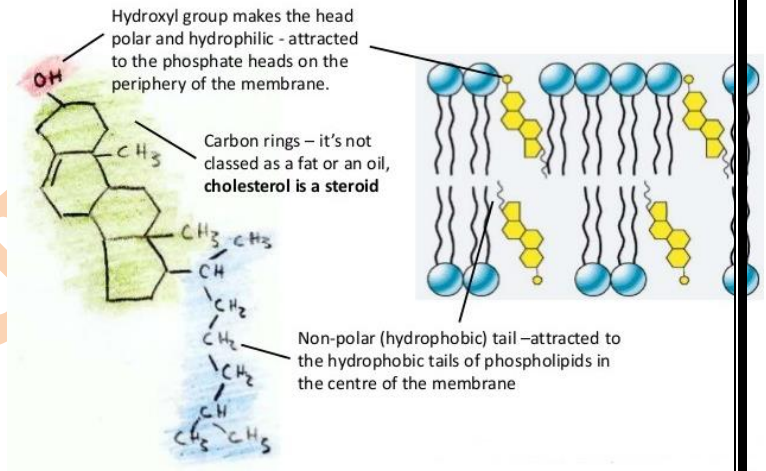
❖ **Introduction**

- Cholesterol is a **waxy, fat-like structural component of cell membranes and serves as a building block for synthesizing various steroid hormones, vitamin D, and bile acids**. Besides their structural role providing stability and fluidity, cholesterol also plays a crucial role in regulating cell function
- Cholesterol is a 27 carbon compound with a unique structure with a hydrocarbon tail, a central sterol nucleus made of four hydrocarbon rings, and a hydroxyl group.
- The centre sterol nucleus or ring is a feature of all steroid hormones.
- The hydrocarbon tail and the central ring are non-polar and therefore do not mix with water. Therefore cholesterol (lipid) is packaged together with apoproteins (protein) in order to be carried through the blood circulation as a lipoprotein.
- Humans can synthesize cholesterol de novo and can also obtain it from the diet. De Novo synthesis occurs in the liver and the intestines
- While all cells can synthesize cholesterol to a small extent, the liver is the major site of cholesterol synthesis.

❖ **Structure of cholesterol**

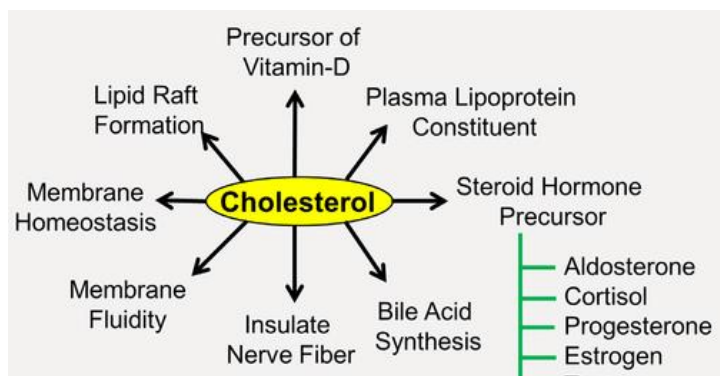


Cholesterol



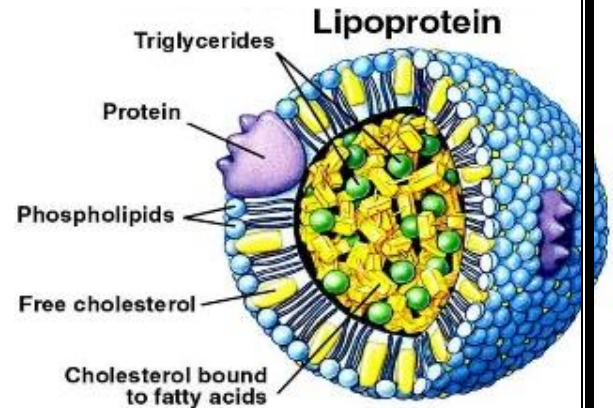
➤ **Functions of cholesterol**

- Building And maintainance of cell membrane
- Essential in determination of cell membrane permeability
- Necessary to production of sex hormone (estrogens and androgens)
- Important for the production of adrenal glands released hormone like cortisol, aldosterone, corticosterone etc.
- Helpful in production of bile
- Conversion of vit-D from sunshine
- Important for the metabolism of fat soluble vitamins like Vit A, D, E and K
- Insulation of nerve fibres



2. Lipoproteins(refer- Pharmacotherapeutics Hyperlipidemia)

- Lipoproteins are **particles made of protein and fats (lipids)**.
Or
- Lipoproteins Comprise proteins and phospholipids that transport cholesterol and triglycerides in the body.
- Outer surface of a lipoprotein contain
 - Apolipoprotein (protein that binds lipids)
 - Phospholipids and free cholesterol.
- Core:
 - Triglycerides (aka, triacylglycerol)
 - Cholesterol esters



➤ Lipoprotein composition

Plasma lipoprotein particles contain variable proportions of four major elements: **cholesterol, triglycerides, phospholipids and specific proteins called apoproteins**

➤ Types of lipoproteins

• Chylomicrons

They deliver dietary triglycerides and cholesterol to the liver and peripheral tissues.

• Chylomicron remnants

They are produced when triglycerides are removed from chylomicrons; thus, they are rich in cholesterol esters.

• Very Low Density Lipoproteins (VLDL)

They are made in the liver, and are rich in triglycerides.

• Intermediate Density Lipoproteins (IDL)

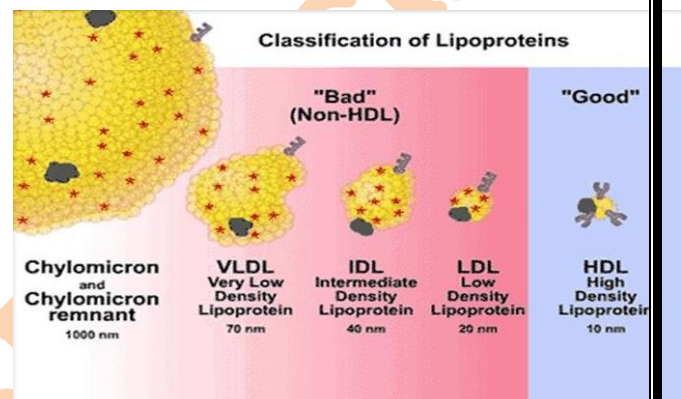
- They are produced when triglycerides are removed from VLDL; thus, like the chylomicron remnants, they are rich in cholesterol.
- Because they are formed from VLDL, Intermediate Density Lipoproteins are sometimes referred to as VLDL remnants.

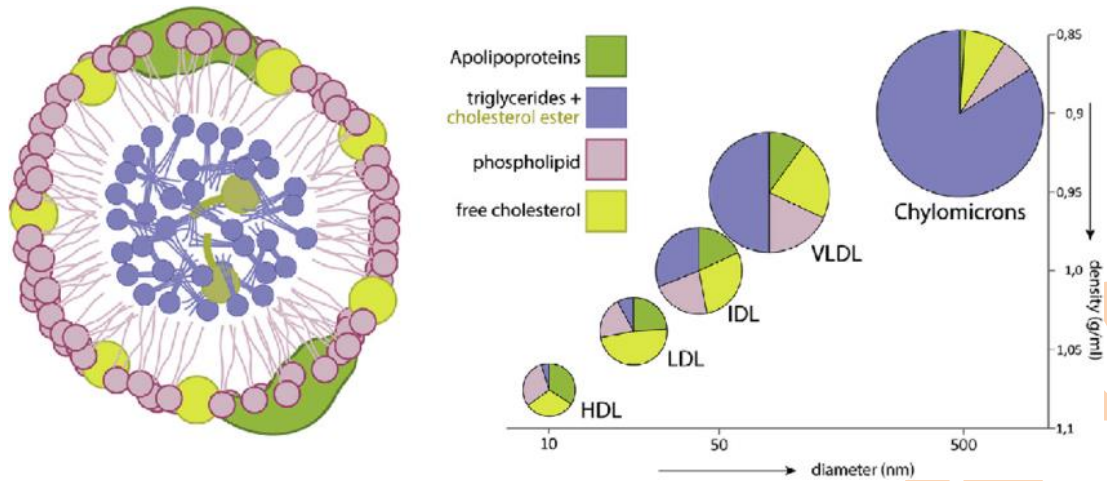
• Low Density Lipoproteins(LDL)

- They are produced after even more triglycerides are removed from the Very Low Density Lipoproteins and their remnants; thus, LDL is very rich in cholesterol, which it carries to the peripheral tissues.
- LDL is sometimes referred to as **"bad" cholesterol**, because it distributes cholesterol throughout the body and vessels.
- In the vessels, the deposited cholesterol contributes to obstructive plaque formation and atherosclerosis.

• High Density Lipoproteins (HDL),

- HDL is **mainly secreted by the liver and small intestines**.
- The liver, which secretes ~70–80% of the total HDL in plasma, is the main source of HDL in the circulation. Apolipoprotein is the major structural protein and constitutes the framework of HDL to bear phospholipids and cholesterol
- They are part of the **reverse cholesterol transport pathway**, carry cholesterol from the peripheral tissues to the liver. Where cholesterol form bile or remove through faeces.
- In addition to removing excess cholesterol, High Density Lipoproteins have various other anti-atherogenic properties, so it they are often referred to as **"Good" cholesterol**.





➤ **Function of lipoproteins**

CLASS	ORIGIN	PHYSIOLOGICAL FUNCTION
Chylomicron	Intestine	Absorption of fats from the diet.
Fragments of Chylomicron	Plasma	Delivers fats from the diet to the liver.
VLDL	Liver	Transports triglycerides from the liver to other tissues.
IDL	Plasma	Initial products formed from VLDL catabolism.
LDL	Plasma	Transports cholesterol esters.
HDL	Liver and Intestine	Removes excess cholesterol from tissues and lipoproteins, and remodels lipoproteins.

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