

Difference Between Cholesterol and Cholesteryl Ester

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Key Difference - Cholesterol vs Cholesteryl Ester

Cholesterol is an important sterol component in animals. It has both structural and functional roles to play in a cellular system. And also cholesterol is an important constituent in High Density Lipoprotein (HDL) and Low Density Lipoprotein (LDL). Therefore it plays a major role in cardiovascular health. Cholesterol and cholesteryl esters are two forms in which cholesterol exists in an animal. Cholesterol is a sterol with a four-membered ring structure with a single hydroxyl group attached to one of the rings. It is the active, raw form of cholesterol. Cholesteryl Ester is the inactive form in which cholesterol is esterified with fatty acids in order to be transported to target organs. The **key difference** between cholesterol and cholesteryl esters is the active and the inactive forms. **Cholesterol is an active sterol form whereas cholesteryl ester is an inactive esterified form in which cholesterol is transported in the circulatory system.**

What is Cholesterol?

Cholesterol is a type of sterol which can be synthesized in the animal hepatic cells with the assistance of the key regulatory enzyme HMG CoA reductase or 3-hydroxy-3-methyl-glutaryl-CoA reductase. Cholesterol can also be obtained via the diet through animal-based food. Thus there are two main sources in which the animal body satisfies its need for cholesterol. The molecular formula of cholesterol is $C_{27}H_{45}OH$. The structure of cholesterol has three main regions; the hydrocarbon chain, the ring structure with four rings and the characteristic hydroxyl group. Due to the presence of the hydrophilic hydroxyl group and the hydrophobic hydrocarbon region cholesterol is termed as an amphipatic molecule. It is slightly soluble in water and forms micelle structures.

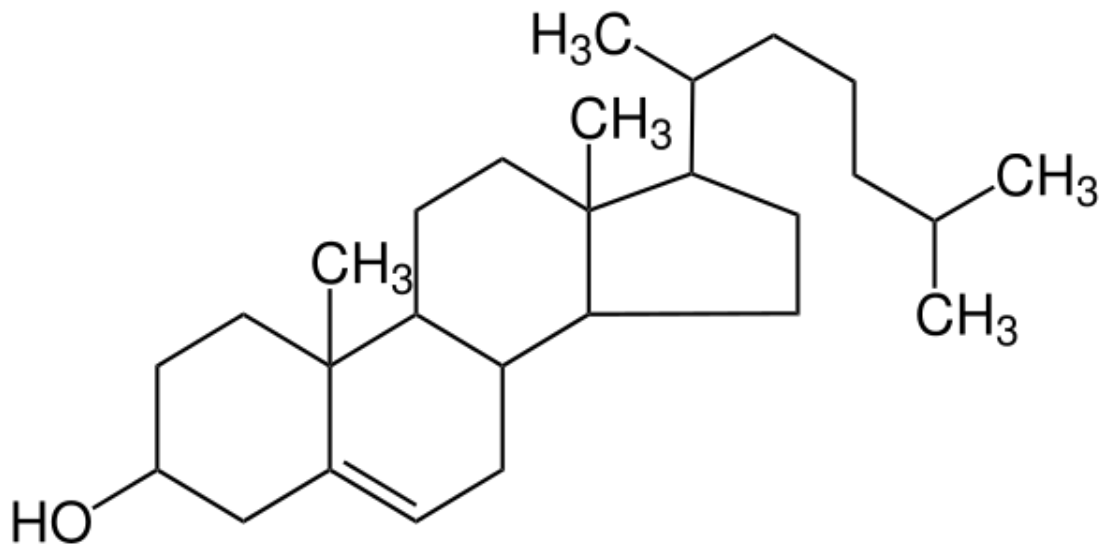


Figure 01: Structure of cholesterol

Cholesterol acts as a structural component in plasma membranes. Cholesterol also increases the fluidity of the membrane. Moreover, cholesterol is a precursor of all steroid hormones which include testosterone and estrogen. The function of Cholesterol is categorized into two main types; High density lipoprotein cholesterol or HDL Cholesterol and Low Density Lipoprotein Cholesterol or LDL Cholesterol. These lipoproteins act as carriers for cholesterol. LDLs carry cholesterol out of the liver and deposit in the periphery. HDL carries cholesterol into the liver. Both these types are vital for cardiovascular health. It is identified that LDL cholesterol is the bad form of cholesterol which leads to the risk of cardiovascular diseases. In contrast, HDL Cholesterol is termed as the good cholesterol as it reduces the risk of cardiovascular diseases.

What is Cholesteryl Ester?

Cholesteryl ester is the inactive form of cholesterol. Cholesteryl Esters are formed when cholesterol is esterified with fatty acids. This is completely hydrophobic. The main importance of converting cholesterol to cholesteryl esters is to facilitate efficient transportation of cholesterol. This conversion increases the amount of cholesterol that can be packaged into the interior of the lipoprotein thus, facilitating more efficient transportation of cholesterol in the blood. The raw cholesterol only binds to the outer surface of the lipoprotein. Therefore less amount of cholesterol can be carried in the blood.

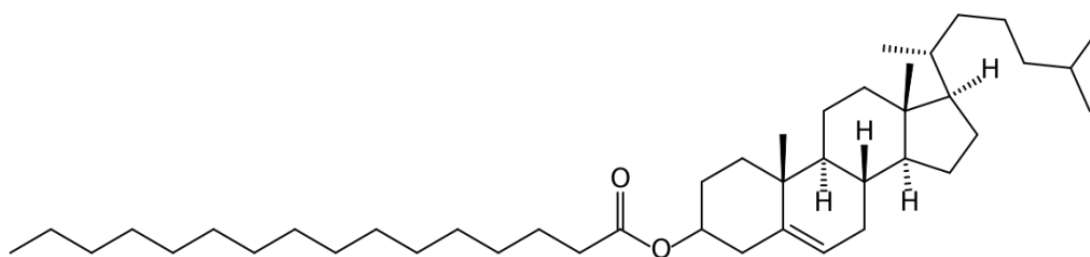


Figure 02: Cholesteryl Esters

The conversion of cholesterol to cholesteryl esters is an enzyme-mediated process. There are two main enzymes involved in this process. The type of enzyme depends on location in which the esterification reaction takes place. In the peripheral tissue, the esterification process is carried out by lecithin-cholesterol acyltransferase (LCAT). The fatty acid moiety used in the esterification reaction is donated by the substrate phosphatidyl choline. In the intestinal lumen, the enzyme acyl-coenzyme A (CoA):cholesterol acyltransferases (ACATs) is used. There are two main types of ACATs. ACAT 1 is found in every tissue whereas ACAT 2 is found specifically in the liver and the intestinal lumen. ACAT uses acyl CoA for the esterification process.

What are the Similarities Between Cholesterol and Cholesteryl Ester?

- Both contain a four-ringed hydrocarbon structure.
- Both can be packaged into lipoproteins.
- Both play a functional role in cardiovascular health and cardiovascular diseases.

What is the Difference Between Cholesterol and Cholesteryl Ester?

Cholesterol vs Cholesteryl Ester	
Cholesterol is a compound of the sterol type found in most body tissues.	Cholesteryl Ester is a derivative of cholesterol in which an ester bond is formed between the carboxylate group of a fatty acid and the hydroxyl group of cholesterol.
Structure	
Cholesterol contains a sterol structure with a hydroxyl group.	Cholesteryl Ester contains esterified structure with nonpolar groups.
Polarity	
Cholesterol is an amphipathic molecule.	Cholesteryl Ester is a hydrophobic and a nonpolar molecule.
Solubility in water	
Cholesterol is sparsely soluble in water.	Cholesteryl Ester is insoluble in water.
Form	
Cholesterol is the active raw form.	Cholesteryl Ester is an inactive form .

Summary - Cholesterol vs Cholesteryl Ester

Cholesterol and cholesteryl esters are the two main forms of cholesterol in the body. Cholesterol is the raw form which is composed of a sterol structure. In order to facilitate efficient packaging and transportation of cholesterol, it is converted to

cholesteryl esters by two main enzymes LCAT and ACAT. Hence cholesteryl ester is derived from cholesterol. This is the difference between cholesterol and cholesteryl ester.

Reference:

1. "Cholesterol Esterification." Sigma-Aldrich. [Available here](#)
2. "The Biochemistry of Cholesterol - Cholesterol Chemistry 101." The Biochemistry of Cholesterol. [Available here](#)

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2. 'Cholesteryl palmitate' By Ayacop - Own work, Public Domain via [Commons Wikimedia](#)

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