

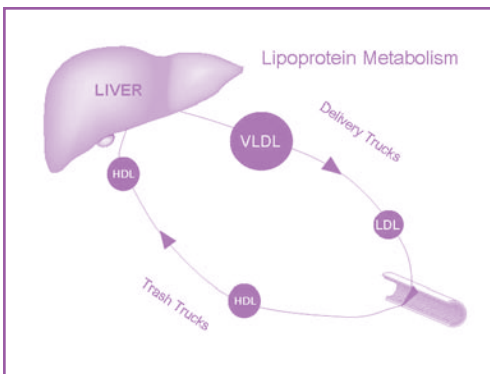
# C is for Cholesterol

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Cholesterol often is portrayed as the bad guy – something to be avoided at all costs. But in truth, we all need it for our bodies to function normally. The problem is when we have an excess: Too much can be deadly. Making things even more complicated is that cholesterol comes in several different packages – some helpful and some harmful.

Cholesterol travels through our bodies in the form of “lipoproteins,” which are composed mostly of cholesterol and triglycerides. They got



their name from the fact that they are coated with proteins to make it easier for them to move through the blood (blood is like water while cholesterol and triglycerides are like oil – and oil and water don’t mix).

Lipoproteins come in different sizes and have different functions, and the different types get their names based on their densities. The major lipoproteins found in our blood after fasting are very low density lipoproteins (VLDL), low density lipoproteins (LDL) and high density lipoproteins (HDL).

## Very Low Density Lipoproteins

This lipoprotein is produced by the liver (see figure at left). Each one is about 80 percent triglycerides and 20 percent cholesterol. As the VLDL lipoproteins circulate throughout the body, an enzyme removes the triglycerides and breaks them down into free fatty acids, which the muscles, especially the heart, use for fuel.

## Low Density Lipoproteins

When the triglycerides are removed from the VLDL, the lipoproteins get even smaller and denser, becoming LDL particles (see figure). This is the form that causes and/or contributes to clogged arteries, or atherosclerosis. It does this by getting stuck in artery walls that are damaged or otherwise dysfunctional. That’s why we call LDL “bad cholesterol.”

## High Density Lipoproteins

There’s another type of lipoprotein called HDL, which is considered the healthy cholesterol. There are tissues besides the liver that make cholesterol; HDL is like a vehicle that picks up this non-liver cholesterol and delivers it to tissues in the body that need it to do their jobs, such as producing hormones. Most of the HDL, however, is taken to the liver, where the cholesterol is removed from the HDL lipoprotein and excreted into the gut in the form of bile.

## Chylomicrons

There is another lipoprotein that is important to note – the chylomicron. It also plays a role in atherosclerosis. The chylomicron is formed when the body digests fats and is therefore present for several hours after we eat.

Like VLDL, these particles have large amounts of triglycerides. As they move through the very small blood vessels (the capillaries), the free fatty acids are removed to be used as fuel for the heart and skeletal muscles. The particles left over are called chylomicrons remnants. These remnants are also cholesterol-rich and contribute to atherosclerosis in the arteries. Unfortunately, these bad particles – while present most of the day – are not measured after a long fast. That is why your physician may on occasion want to obtain a non-fasting blood lipid panel.

## Total Cholesterol Score Has Limited Value

Because some of the lipoproteins are good and some are bad, looking at only your total cholesterol score – a combination of the different types – is not very helpful. Someone whose total cholesterol score is 200 mg/dL but who has mostly bad cholesterol is far worse off than someone who has a score of 200 but has lots of good cholesterol.

## Determinants of Blood Cholesterol

So what determines how much cholesterol is in our blood? There are three major factors: the amount of cholesterol absorbed from the gut, the amount of cholesterol produced by the liver, and the amount of cholesterol removed from the blood by the liver.

An average person consumes about 300 mg of cholesterol each day. But the liver is delivering about 900 mg during the same time frame and putting it into the gut (in the form of bile).

## HEART NEWS FOR YOU

That means we have 1,200 mg of cholesterol coming into our gastrointestinal system every day. If you go on a low-cholesterol diet and slash your intake to 100 mg, your small intestine (where cholesterol is absorbed) is still getting 1,000 mg of cholesterol.

Cholesterol is removed from the blood by the liver through a process that can be compared to a system of locks and keys. To simplify the process, imagine that lipoproteins are covered by keys in search of their locks. Only those cells with receptors (locks) that match can accept the keys. The liver is covered in locks: When the LDL particles come by, their keys get caught in those locks and the liver pulls them inside. As you can deduce, the number of locks, or receptor cells on the liver, has an impact on how much LDL is in our blood. The number of receptors is determined by heredity (pick your parents carefully!) and age. The older we get, the fewer receptors we have on our livers.

### Medications

As you can see, diets are limited in their impact on cholesterol levels. So if diet won't work – and we can't choose our parents or keep ourselves from getting older – what about making the liver produce less cholesterol and also work harder to remove it from the bloodstream? This is where medications come in.

There are several types of drugs that lower total and LDL cholesterol. The most effective are the “statin” drugs, which lower cholesterol by blocking the liver's production of VLDL and increasing the number of LDL receptors (locks) on the liver. There also are some “alternative” agents used to decrease cholesterol, such as red yeast rice extract, which

contains lovastatin (one of the many statins on the market). The major concern about alternative “medicines” is that they are not regulated by the Food and Drug Administration and so their purity and the concentrations are not known. And since they are not usually prescribed by physicians, no one is monitoring patients taking them for effects or side effects. It is sad to see a patient who is spending a considerable amount of money, thinking they are doing the correct thing by taking natural products, only to find that the products are not very effective.

For some patients who have optimal LDL levels but low HDL levels, moderate alcohol intake and vigorous exercise can be helpful. Doctors also can prescribe drugs, such as niacin and the fibrates, that increase HDL.

To address the problem of cholesterol-rich chylomicrons, scientists developed a class of drugs called cholesterol absorption blockers (ezetimibe is the first drug of this new class). Ezetimibe blocks about 50 percent of cholesterol absorption in the small intestine, thus decreasing the amount of cholesterol in the chylomicrons.

Combining ezetimibe and statins is particularly effective in lowering LDL cholesterol, without having to use high-dose statins. Evidence from older drug trials indicates that blocking cholesterol absorption by ileal bypass surgery or with drugs that decrease cholesterol absorption by binding the cholesterol in bile also decreases cardiovascular events.

### What Should My Cholesterol Be?

A number of studies indicate that the amount of LDL should be less than 70 mg/dL in people with or at very high risk for the complications

## By the Numbers

- √ **300 mg**  
The amount of cholesterol the average person consumes each day
- √ **900 mg**  
The amount of cholesterol an average person's liver delivers each day
- √ **70 mg**  
The upper limit for LDL cholesterol in people with coronary disease

**The ABCs of Preventing Heart and Vascular Disease** is a series of articles examining risk factors for cardiovascular disease.

Previous issues covered **A is for Antiplatelet Therapy/Aspirin** and **B is for Blood Pressure**.

of coronary disease. HDL should be greater than 40 mg/dL in a man and greater than 50 mg/dL in a woman.

Managing lipid abnormalities – such as LDL that's too high, HDL that's too low or too many cholesterol-rich chylomicrons – is essential if we want to decrease death and disability from cardiovascular disease, America's No. 1 killer.

If you don't know your levels, get them tested. And then talk to your doctor about the best way to maintain a healthy balance.<sup>a</sup>