Understanding Cholesterol: The Good, the Bad, and the Necessary

Excerpted from The Harvard Medical School Guide to Lowering Your Cholesterol

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High cholesterol is a serious health problem that affects about fifty million Americans. It's a major risk factor for cardiovascular disease (CVD), which half of all men and a third of all women will get at some time in their lives. I'll spend the majority of this book on the two things my patients ask about most: how cholesterol and heart disease are connected and what they can do to optimize their cholesterol levels. But I want to take a few pages early on to clarify that cholesterol in and of itself isn't bad. While too much cholesterol can be harmful, just the right amount of it does a lot of important work in the body. But like carbohydrates in recent years, cholesterol has gotten such a bad rap that most people don't know the good it does.

Cholesterol performs three main functions;

1. It helps make the outer coating of cells.
2. It makes up the bile acids that work to digest food in the intestine.
3. It allows the body to make Vitamin D and hormones, like estrogen in women and testosterone in men.

Without cholesterol, none of these functions would take place, and without these functions, human beings wouldn't exist.

**What Is Cholesterol?**

Cholesterol is a fat, or lipid. It is also a sterol, from which steroid hormones are made. If you held cholesterol in your hand, you would see a waxy substance that resembles the very fine scrapings of a whitish-yellow candle. Cholesterol flows through your body via your bloodstream, but this is not a simple process. Because lipids are oil-based and blood is water-based, they don't mix. If cholesterol were simply dumped into your bloodstream, it would congeal into unusable globs. To get around this problem, the body packages cholesterol and other fats into minuscule protein-covered particles called lipoproteins (lipid + protein) that do mix easily with blood. The proteins used are known as apolipoproteins.

The fat in these particles is made up of cholesterol and triglycerides and a third material I won't discuss much, phospholipid, which helps make the whole particle stick together. Triglycerides are a particular type of fat that have three fatty acids attached to an alcohol called glycerol—hence the name. They compose about 90 percent of the fat in the food you eat. The body needs triglycerides for energy, but as with cholesterol, too much is bad for the arteries and the heart.

**A Lipoprotein by Any Other Name**

The two main types of lipoproteins important in a discussion on heart disease are low-density lipoproteins (LDL) and high-density lipoproteins (HDL). Though the names sound the same, these two particles are as different as night and day. The differences stem from their densities, which are a reflection of the ratio of protein to lipid; particles with more fat and less protein have a lower density than their high-protein, low-fat counterparts. There are countless other lipoproteins, some of which I'll discuss in later chapters, but in order to get a basic understanding of how cholesterol affects your body and how the food you eat affects your cholesterol levels, LDL and HDL are the ones to start with.

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| **What Are the Different Types of Fats?**  Most people are vaguely familiar with the terms saturated and unsaturated fat. But what do they really mean? All fats have a similar chemical structure: a chain of carbon atoms bonded to hydrogen atoms. What differs is the length and shape of their carbon atoms and the number of hydrogen atoms. These slight structural differences create crucial differences in how the body reacts to them. I'll go into more detail about diet and cholesterol in Chapter 6, but for now, here's a primer:   * **Saturated fat.** The word saturated here refers to the number of hydrogen atoms these fats have. The chain of carbon atoms that makes up these fats holds as many hydrogen atoms as possible, so they're saturated. Saturated fats are unhealthy. * **Unsaturated fat.** These have fewer hydrogen atoms and are healthy for you. There are two different kinds of unsaturated fats: polyunsaturated and monounsaturated. Polyunsaturated fats, like omega-3 fats and omega-6 fats, have four or more carbons that are not saturated with hydrogens. Monounsaturated fats have just one pair of carbon molecules that are not saturated with hydrogens. |

**Low-Density Lipoproteins (LDL)**

In most people, 60 to 70% of cholesterol is carried in LDL particles. LDL particles act as ferries, taking cholesterol to the parts of the body that need it at any given time. Unfortunately, if you have too much LDL in the bloodstream, it deposits the cholesterol into the arteries, which can cause blockages and lead to heart attacks. That's why people refer to LDL as the "bad" cholesterol. LDLs circulate in the bloodstream and bind to receptor sites on cell membranes before being taken up by the cell. Excess LDLs in the diet over load the receptors leading to elevated blood cholesterol levels. The good news is that the amount of LDL in your blood-stream is related to the amount of saturated fat and cholesterol you eat. So, most people can decrease their LDL if they follow a reduced-fat diet. When you get a fasting cholesterol test, your doctor should test for the level of LDL cholesterol.

**High-Density Lipoproteins (HDL)**

HDL is basically the opposite of LDL. Instead of having a lot of fat, HDL has a lot of protein. Instead of ferrying cholesterol around the body, HDL acts as a vacuum cleaner sucking up as much excess cholesterol as it can (see Figure 1.1). It picks up extra cholesterol from the cells and tissues and takes it back to the liver, which takes the cholesterol out of the particle and either uses it to make bile or recycles it. This action is thought to explain why high levels of HDL are associated with low risk for heart disease. HDL also contains antioxidant molecules that may prevent LDL from being changed into a lipoprotein that is even more likely to cause heart disease. Lifestyle changes affect HDL levels—exercise can increase them, while obesity and smoking lower them. As for diet, in general, the high-fat diets that raise LDL also raise HDL, while low-fat diets lower both. However, by carefully choosing the right foods, you can eat a diet that lowers LDL without lowering HDL, as I'll discuss in Chapter 6.

**You Mean My Body Makes Cholesterol?**

Cholesterol is so important to the body that it makes it itself—Mother Nature doesn't leave it up to humans to get whatever they need from diet alone. So even if you ate a completely cholesterol-free diet, your body would make the approximately 1,000 mg it needs to function properly. Your body has the ability to regulate the amount of cholesterol in the blood, producing more when your diet doesn't provide adequate amounts. The regulation of cholesterol synthesis is an elegant process that is tightly controlled.

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| **FIGURE 1.1 HDL to the Rescue**  **http://www.health.harvard.edu/newsweek/images/Understanding_Cholesterol_clip_image002.jpg**  High cholesterol levels result in atherosclerosis, a narrowing or hardening of the arteries that can cause heart disease, stroke, and other major health problems. Fortunately, the body uses its own "good" cholesterol to clear out the "bad" cholesterol before it becomes harmful. |