**SULFUR**: The Hidden Factor Behind Obesity, Heart Disease, and Chronic Fatigue

By Dr. Mercola

Dr. Stephanie Seneff is a senior scientist at MIT and has been conducting research there for over three decades. However, she also has an undergraduate degree in biology from MIT, and a minor in food and nutrition. She's affiliated with the Weston A. Price Foundation and will be speaking at their November Dallas conference, and so will I. Dr. Seneff has a wealth of information in an area that many are not very knowledgeable about, and that is the importance of sulfur.

Sulfur deficiency is pervasive, and may be a contributing factor in:

- Obesity
- Heart disease
- Alzheimer's disease
- Chronic fatigue
- And more

She also believes conventional medicine is seriously confused about cholesterol, which is closely interrelated with sulfur. Furthermore, healthy cholesterol and sulfur levels are also highly dependent on your vitamin D levels! Here, she discusses the importance and the intricate relationships among these three factors.

**Heart Disease May be a Cholesterol Deficiency Problem...**

Considering the fact that conventional medicine has been telling us that heart disease is due to elevated cholesterol and recommends lowering cholesterol levels as much as possible, Dr. Seneff's claims may come as a complete shock:

"Heart disease, I think, is a cholesterol deficiency problem, and in particular a cholesterol sulfate deficiency problem..."

She points out that all of this information is available in the research literature, but it requires putting all the pieces together to see the full picture. Through her research, she believes that the mechanism we call "cardiovascular disease," of which arterial plaque
is a hallmark, is actually your body's way to compensate for not having enough cholesterol sulfate.

She explains:

"The macrophages in the plaque take up LDL, the small dense LDL particles that have been damaged by sugar... The liver cannot take them back because the receptor can't receive them, because they are gummed with sugar basically. So they're stuck floating in your body... Those macrophages in the plaque do a heroic job in taking that gummed up LDL out of the blood circulation, carefully extracting the cholesterol from it to save it – the cholesterol is important – and then exporting the cholesterol into HDL – HDL A1 in particular... That's the good guy, HDL.

The platelets in the plaque take in HDL A1 cholesterol and they won't take anything else... They take in sulfate, and they produce cholesterol sulfate in the plaque.

The sulfate actually comes from homocysteine. Elevated homocysteine is another risk factor for heart disease. Homocysteine is a source of sulfate. It also involves hemoglobin. You have to consume energy to produce a sulfate from homocysteine, and the red blood cells actually supply the ATP to the plaque.

So everything is there and the intent is to produce cholesterol sulfate and it's done in the arteries feeding the heart, because it's the heart that needs the cholesterol sulfate. If [cholesterol sulfate is not produced]... you end up with heart failure."

So, in a nutshell, high LDL appears to be a sign of cholesterol sulfate deficiency—it's your body's way of trying to maintain the correct balance by taking damaged LDL and turning it into plaque, within which the blood platelets produce the cholesterol sulfate your heart and brain needs for optimal function... What this also means is that when you artificially lower your cholesterol with a statin drug, which effectively reduces that plaque but doesn't address the root problem, your body is not able to compensate any longer, and as a result of lack of cholesterol sulfate you may end up with heart failure.

**IMPORTANT UPDATE: How Sun Exposure Impacts Your Sulfur Status**

According to the conventional view, high LDL is correlated with heart disease, so the idea is that you can take a statin drug to artificially reduce the LDL and you'll be fine. However, as Dr. Seneff explains, if you have high LDL, it's because your body probably needs it to produce cholesterol sulfate, which your heart requires for optimal function. Hence, when you simply remove the LDL, you also remove your body's "backup"
mechanism to keep your heart as healthy as possible, and as a result you get heart failure.

But high LDL is correlated with cardiovascular disease (please note that cardiovascular disease is an entirely different disease category from heart failure, which explains a lot of the confusion on this issue), so how can your body produce cholesterol sulfate without the harmful LDL?

How is it produced under normal, healthy conditions?

This is where sun exposure enters the picture. When you expose your skin to sunshine, your skin synthesizes *vitamin D3 sulfate*. This form of vitamin D is water soluble, unlike oral vitamin D3 supplements, which is unsulfated. The water soluble form can travel freely in your blood stream, whereas the unsulfated form needs LDL (the so-called "bad" cholesterol) as a vehicle of transport.

Her suspicion is that the simple oral non-sulfated form of vitamin D likely will not provide the same benefits as the vitamin D created in your skin from sun exposure, because it cannot be converted to vitamin D sulfate. This is yet another reason to really make a concerted effort to get ALL your vitamin D requirements from exposure to sunshine!

"[S]ulfate actually inactivates vitamin D," Dr. Seneff says. "The sulfated form of vitamin D does not work for calcium transport, which I find very intriguing. And in fact, I think it's the sulfated form for vitamin D that offers the protection from cancer. It strengthens your immune system. It protects you from cardiovascular disease. It's good for your brain. It helps depression. I think all of those effects of vitamin D are effects of vitamin D sulfate."

For those who are still under the mistaken impression that sun exposure is the primary cause of skin cancer, the following explanation may be of great help. In a Weston A. Price article on sulfur,

Dr. Seneff states that:

"Both cholesterol and sulfur afford protection in the skin from radiation damage to the cell's DNA, the kind of damage that can lead to skin cancer. Cholesterol and sulfur become oxidized upon exposure to the high frequency rays in sunlight, thus acting as antioxidants to "take the heat," so to speak. Oxidation of cholesterol is the first step in the process by which cholesterol transforms itself into vitamin D3."

As I've stated before, your body was designed to be exposed to the rays of the sun, and your skin contains all the necessary mechanisms to extract or produce beneficial nutrients from it while simultaneously shielding itself from harm. When you circumvent this natural process, either by using sunblock or staying out of the sun entirely, you lose all the health benefits, and give a variety of disease processes free reign.

**Cholesterol Sulfate—The Link Between Obesity and Lack of Sun Exposure?**

Furthermore, your skin also produces huge amounts of *cholesterol sulfate*, which is also water soluble and provides a healthy barrier against bacteria and other potentially disease-causing pathogens that might otherwise enter your body through your skin. And, due to its polarity, it can enter both fat cells and muscle cells with equal ease. Dr. Seneff proposes that, because of this, cholesterol sulfate may be able to protect fat and muscle cells from glucose and oxygen damage.

She also argues that when you're deficient in cholesterol sulfate, your muscle and fat cells become more prone to damage, which subsequently can lead to glucose intolerance; a condition where your muscles cannot process glucose as a fuel. As a result, your fat cells have to store more fat in order to supply fuel to your muscles, and excess fat accumulates as damage increases.

Sulfur also plays an important role in glucose metabolism. She hypothesizes that if sufficient amounts of sulfur is available, it will act as a decoy to glucose, effectively diverting it to reduce the sulfur rather than glycating and causing damage. This would have the beneficial effect of reducing inflammation, as sugar (glucose) is highly inflammatory and wreaks havoc in your body.

**The Many Roles of Sulfur**

Overall, sulfate appears to be a highly underestimated molecule with vast health implications. Dr. Seneff discusses her findings in great detail, but offers the following analogy:

"[I]f you breakdown the sulfate you will release energy, which means that the sulfate is actually absorbing the energy from light... I think of the skin as a battery – or solar panel you might say – taking in the sun's energy and saving it in the form of the sulfate molecule storing the energy in the sun."
It seems logical that humans would have some capacity to absorb energy from the sun directly, but this is the first time I've heard of a molecular explanation for this capacity!

"I have a lot of thoughts about what sulfate does," Dr. Senef says. "One thing I'm quite sure of is that cholesterol sulfate is highly protective against bacterial and virus invasions. That's why sun exposure protects you from infection. It strengthens your immune system. That cholesterol sulfate is incredibly important to immunity."

Sulfur also plays a vital role in the structure and biological activity of both proteins and enzymes. If you don't have sufficient amounts of sulfur in your body, this deficiency can cascade into a number of health problems as it will affect bones, joints, connective tissues, metabolic processes, and more.

Other areas where sulfur plays an important role include:

- Your body's electron transport system, as part of iron/sulfur proteins in mitochondria, the energy factories of your cells
- Vitamin-B thiamine (B1) and biotin conversion, which in turn are essential for converting carbohydrates into energy
- Synthesizing important metabolic intermediates, such as glutathione
- Proper insulin function. The insulin molecule consists of two amino acid chains connected to each other by sulfur bridges, without which the insulin cannot perform its biological activity
- Detoxification

**Sulfate—Essential for Babies**

Cholesterol sulfate is also essential for babies in utero. A woman has about 1.5 units of cholesterol sulfate normally in her blood. When she gets pregnant, her blood levels of cholesterol sulfate steadily rise, and it also begins to accumulate in the villi in the placenta—which is where nutrients are transferred from the placenta to the baby. At the end of pregnancy the cholesterol sulfate in the villi rises to levels of about 24 units!

Colostrum also contains high levels of sulfur, even more than the breast milk itself. So clearly, nature seeks to provide the baby with plenty of both sulfur and cholesterol at the time of birth. Interestingly enough, when a mother has high serum cholesterol, the baby’s levels are typically low.

Why?
Dr. Seneff explains:

"[Because] it can't get through. The mother has high serum cholesterol I think because she has low serum cholesterol sulfate. I think the two go together. The way to bring down your LDL in a healthy way is to get sunlight exposure on your skin. Your skin will produce cholesterol sulfate, which will then flow freely to the blood—not packaged up inside LDL—and therefore your liver doesn't have to make so much LDL. So the LDL goes down.

In fact... there is a complete inverse relationship between sunlight and cardiovascular disease – the more sunlight, the less cardiovascular disease."

Now, when a baby is born of a mother who has high cholesterol and low cholesterol sulfate, the baby's cholesterol will be low, but will also have fatty deposits in its arteries...despite the fact that fatty deposits are supposed to be associated with high cholesterol.

"The deposits are there, I think, to start this cholesterol sulfate program that's replacing the one that isn't happening..." Dr. Sennett explains. "Children who have adequate cholesterol sulfate delivered from their mother do not have fatty deposits... It's bizarre, but the high cholesterol associated with fatty deposits in the adult (that's causing heart disease) is a solution, not a cause."

This is a complete turnaround in thinking compared to the conventional paradigm!

Furthermore:

"The worst thing you can do is to clobber the LDL... because you're going to end up with heart failure," Dr. Seneff says..

**Dietary Sources of Sulfur**

Sulfur is derived almost exclusively from dietary protein, such as fish and high-quality (organic and/or grass-fed/pastured) beef and poultry. Meat and fish are considered "complete" as they contain all the sulfur-containing amino acids you need to produce new protein. Needless to say, those who abstain from animal protein are placing themselves at far greater risk of sulfur deficiency.

Coconut oil and olive oil also contain sulfur (and are ideal sources of healthful saturated fats too). Other dietary sources that contain small amounts of sulfur IF the food was grown in soil that contains adequate amounts of sulfur, include:
Any diet high in grains and processed foods is likely to be deficient in sulfur, because once whole foods are processed, sulfur is lost. Additionally, soils around the world are becoming increasingly sulfur-depleted, resulting in less sulfur-rich foods overall. Hard water also tends to contain more sulfur than soft water, which, according to Dr. Seneff, may be why people who drink soft water are at greater risk of developing heart disease. In addition to making sure you're getting high amounts of sulfur-rich foods in your diet, Dr. Seneff recommends soaking your body in magnesium sulfate (Epsom salt) baths to compensate and counteract sulfur deficiency. She uses about ¼ cup in a tub of water, twice a week. It's particularly useful if you have joint problems or arthritis.

As for supplements, methylsulfonylmethane, commonly known by its acronym, MSM, is an option. MSM is an organic form of sulfur and a potent antioxidant, naturally found in many plants.