



Vitamin C: Essential for Immune Function

This illustration shows how the white blood cells of your immune system work and the best way to nourish them with vitamin C.

Imagine that you have been miniaturized to microscopic size and now find yourself in the bloodstream looking down the length of a blood vessel. There is a continual stream of material flowing toward you, including a long line of white blood cells that have been made more active by vitamin C. They move as if on patrol, searching the blood for any toxic substances or viral or bacterial foreign invaders. When in close proximity to one of these invaders,

such as bacteria, the white blood cell forms a tentacle-like projection (called a pseudopod) that extends out from the surface of the cell and wraps itself around the invading bacteria, drawing it into the cell to destroy it.

While grasping the bacteria, the white blood cell in the foreground has extended its tentacle-like projection so close to you that the microscopic structure of its membrane can be clearly seen. A cut-away view reveals two layers of the membrane, an inner and an outer layer, composed of millions of round, fat molecules. Also visible is vitamin C and

supportive substances called "vitamin C metabolites"—all simultaneously present to provide the cell with the most complete vitamin C nourishment possible. The ammunition needed to destroy the infection-causing bacteria is released inside the cell. It consists of powerful enzymes and substances called oxygen free radicals that destroy bacteria on contact. (Important note: vitamin C inside the cell helps protect it from being damaged by its own infection fighting ammunition.) You are now an eyewitness to the fact that vitamin C is essential for immune function.

The Importance of Vitamin C for Immune Function

Vitamin C, arguably the most famous of all the vitamins, is essential for general good health and well-being. Some of the many important biochemical reactions and processes that require vitamin C include: normal growth and development; collagen formation for strong connective tissue and healthy skin; healing and repair of wounds; adrenal gland function and hormone production (especially important in times of high stress and/or inflammation); proper cholesterol metabolism; bile production for adequate digestion; alcohol, drug, and smoking detoxification; protection of the body's cells from the damaging effects of pollution and harmful substances called free radicals; adequate dietary iron absorption; and immune function. Vitamin C's role in supporting the body's response to infection may be its most valuable property.

Immune Function Support

Factors known to help our bodies fight infection include eating a balanced diet consisting of high fiber, high complex carbohydrates, and moderate protein in the form of fresh, whole, unprocessed foods; good psychological health achieved through stress control, positive thinking, visualization, and rewarding activity; and good physical conditioning through aerobic exercise, passive stretching, adequate sleep, rest, and relaxation.

Since the publishing of Dr. Linus Pauling's book, *Vitamin C and the Common Cold*, many people have sworn by large doses of vitamin C as one of the ways to help keep from getting sick. Some scientific data suggests that vitamin C is associated with a reduced incidence of the common cold. In addition, several studies indicate that vitamin C supplementation is associated with a shortened duration and a lessening in the severity of cold symptoms.

Although more study is needed to clearly establish the role of vitamin C, current research is very encouraging. Some studies have indicated that vitamin C may help increase the activity of specific white blood cells, the cells involved in fighting infection. It has been observed that in the presence of vitamin C, white blood cell movement may be stimulated and their ability to destroy bacteria enhanced. It has also been noted that certain virus growth may be inhibited when vitamin C is present.

Optimal Benefit From Vitamin C

Because of positive research findings, and often a positive personal experience, many people regularly take vitamin C. But human beings face a significant problem in trying to ensure that adequate vitamin C is available when the body needs it. Unlike many animals, humans lack the ability to manufacture vitamin C. Having this ability affords animals a distinct advantage because they automatically produce more when it is needed. For example, goats will manufacture a remarkable 600% more vitamin C to meet their needs during times of physical stress.

Humans, however, must depend on diet or vitamin C supplements to meet their needs. As such, many people may wonder, "What is the best way to help ensure that my body will absorb and utilize an adequate level of vitamin C when I need it most?" The answer is clear: by providing a form of the vitamin that is easily absorbed, well-tolerated, and effective.

Choosing the Best Form of Vitamin C for You

Basic vitamin C, called *ascorbic acid* due to its acid nature, can sometimes irritate the mouth and stomach, and cause gas and diarrhea when taken in moderate to high quantities.

A well-tolerated form of vitamin C is a blend of *mineral ascorbates*. A mineral ascorbate is vitamin C bonded to a mineral—calcium, magnesium, sodium, potassium, etc.—that makes the vitamin C less acidic, and therefore less irritating to the stomach and intestine.

Along with a blend of mineral ascorbates, look for a very unique form of vitamin C called *ascorbyl palmitate*. Ascorbyl palmitate is vitamin C bonded to palmitic acid. It is postulated that the palmitic acid portion of the molecule permits the vitamin C to attach to, and become embedded in, the fatty membrane of the white blood cell. This may allow for more efficient vitamin C uptake by white blood cells.

Another important feature to look for is vitamin C metabolites. A *metabolite* is a product of the biological transformation of a raw material into compounds that have direct actions in the body. When vitamin C metabolites are added to a nutritional supplement formula, the functional activity of vitamin C may be enhanced. For example, the metabolites ribose and xylitol may help to slow the breakdown of vitamin C by a mechanism known as feedback inhibition. An additional advantage of vitamin C metabolite mixtures is that acidity is neutralized, and they rarely cause stomach or intestinal upset. These attributes result in an excellent form of vitamin C that is well tolerated by most people.