

## Copper Can You Live With Out It Or Not?

Copper is an essential trace mineral necessary for life, and it is necessary for the proper function of certain enzymes that allow certain biochemical functions of the body to take place. Without copper neither plant nor animal life would be possible.

Dietary sources include nuts, grains, seeds, beans and other vegetable protein sources. Although it is also obtained from animal sources, these tend to be rich in zinc, and for reasons that will be discussed shortly, the presence of zinc can deplete copper absorption. Other common sources are copper cooking utensils and drinking water from copper pipes. After digestion, copper is absorbed into the body through the stomach and the small intestine. It is also possible for copper to be absorbed through the skin from copper bracelets.

Once absorbed, copper is bound to albumin and taken by the blood to the liver, where it is bound to a plasma protein known as ceruloplasmin. Among the enzymes with which copper is associated as a 'helper' are Cytochrome C oxidase, used in the conversion of glucose to energy, Dopamine hydroxylase, an essential component in the biochemical production of adrenaline, and superoxidase dismutase, that protects against the oxidative damage of cell tissue. Of particular benefit are its anti-inflammatory and antioxidant properties, and its role in energy production. Because of its antioxidant effect, copper could well play a very important role in protecting against atherosclerosis, and cardiovascular disease, the ravaging effects of free radicals on body cells and also certain forms of cancer.

Copper is also important in electron transport, and is responsible for the blue coloration of the blood of most molluscs and many arthropods. This is because rather than hemoglobin, these animals use the copper-based hemocyanin for oxygen transport in the blood. Rather than the iron-containing hemoglobin making the blood of these creatures red as it is with mammals, theirs is blue due to the hemocyanin. Copper salts are generally green and blue, as are the blue copper proteins plastocyanin and azurin.

So how is copper used by the body? It is, after all, fairly toxic, as little as 30 grams being fatal to humans, bringing on similar symptoms to those of arsenic poisoning. It is in fact the reason for its toxicity that also renders it so useful to the body. The toxicity is largely due to the ability of copper to accept and donate electrons as it changes between oxidation states. This results in the generation of very reactive radicals that can cause severe oxidative stress. The complete reason for its toxicity has yet to be determined, but the stress caused to body cells by free radical oxidation is a very serious condition.

It is this rapid change in its oxidation state that is valuable to the enzymes with which it is associated. The ceruloplasmin is responsible for most of the transport of bivalent copper around the body, in the tissues of which it helps to form the bivalent copper enzymes previously mentioned, such as Cytochrome C oxidase and Lysyl oxidase. In doing so the copper is converted to the monovalent state.

It also helps to aid in the production of the strong antioxidant Superoxide dismutase (SOD). What this enzyme does is to catalyze the formation of oxygen and hydrogen peroxide by the dismutation of superoxide, a negative ion consisting of two oxygen atoms and a free electron, and hence a very powerful free radical. Dismutation is the simultaneous oxidation and reduction of the species, rendering the free radical relatively harmless. This type of action on free radicals is a very powerful one, and essential in the body's fight against such free radical species that are so dangerous to animal cells.

SOD exists in more than one form, and can also contain zinc, manganese and nickel in addition to copper. The internal fluid (cytosol) of practically all eukaryotic cells (cells containing a nucleus) contain a form of Superoxide dismutase dependent on copper and zinc, while most mitochondria contain an SOD with manganese.

Another of the important uses that your body can find for copper lies in the production of hemoglobin. This is because copper is needed for the storage and release of iron to produce hemoglobin, the protein in red blood cells. It is believed that ceruloplasmin is involved in the catalytic formation of ferric iron by the oxidation of ferrous iron, so allowing the iron to be attached to a protein that transfers it round the body to enable its use in the biosynthesis of various ferrous compounds, especially of hemoglobin.

Copper bracelets are commonly worn by arthritis sufferers, and there is a scientific explanation for that. As previously inferred, it is believed to be possible to absorb copper through the skin and copper is known to be involved in the formation of collagen and is a commonly used treatment for arthritis and osteoporosis. Part of its effect on arthritis is likely due to the antioxidant effect of the SOD that helps to reduce the inflammation at arthritis sites.

Although a deficiency in copper can lead to serious health problems, an excess is also harmful. Potential conditions include neurological problems, liver damage and bone abnormalities, although deficiency is far more common because of the competition between copper and zinc. Zinc is a copper

antagonist, as is iron and manganese, and copper imbalances can be moderated by the use of these as supplements.

The symptoms of a copper deficiency include fatigue, hair loss, stunted growth, anorexia and a host of other conditions. Luckily, however, a deficiency is rare and most people receive a sufficient amount of copper in their diet. Supplements are available to ensure an adequate intake.

There is still much to be learned about the interaction between copper and enzymes, and there is also a great deal still to be learned of its role in human metabolism and biochemistry than is currently known. However, sufficient is known already for us to be certain that copper is a very important trace element and that we should be certain that our intake is sufficient, given that zinc iron and manganese compete to prevent copper being absorbed by the body.

## About the Author

More information on [elemental copper](#) is available at VitaNet &reg;, LLC Health Food Store. <http://vitanetonline.com/>

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