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Copper: Your Body's Protective & Anti-Aging Metal

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Copper's protective and anti-aging actions

We are often asked about the relationship between copper, health, and the effect of using copper-peptide cosmetic products. Copper is an essential metal and the intake of copper at reasonable levels should improve your health. The generally recommended dosages per day of copper range from 1 to 3 milligrams daily, however, recent human studies suggest that 4 to 7 milligrams of supplemental copper daily might greatly reduce the rates of some degenerative diseases.

Copper deficiency in animals causes increased cellular oxidation, increased cancer, increased cardiovascular risk, more atherosclerosis, higher LDL-cholesterol, decreased HDL-cholesterol, more lipid oxidation, aortic aneurysms, osteoarthritis, rheumatoid arthritis, osteoporosis, chronic conditions involving bone and connective tissue, brain defects in newborn, obesity, graying of hair, increased sensitivity to pain and lower brain enkephalins, accelerated development of Alzheimer's disease, obesity, and reproductive problems. See more below.

In humans, copper deficiency is associated with all of the above plus depression, impaired brain function, and general fatigue.

Some copper recommendations are based on the recommended zinc dietary levels, and maintaining what these nutritionists feels is a proper zinc to copper ratio. Other recent studies in humans found that supplementation with 3 to 6 milligrams of copper daily had positive actions such as reducing damaging cellular oxidation and lowering cholesterol and LDL levels, while increasing HDL levels. See more below.

Metabolically active copper

In the body, copper moves between cuprous (copper 1 or Cu 1+) form and the cupric (copper 2 or Cu 2+) form. The majority of the body's copper is in the Copper 2 form. The copper type that induces tissue regeneration and skin repair is copper 2. Copper 2 is also what is called the body's copper called is called "metabolically active copper". Copper 2 gives a blue color in water and forms products that usually are blue to green in color when formulated into creams, lotions, and solutions. Copper 1 has no tissue regenerative or skin repair activity and is colorless in water.

Only a very small fraction, less that 1% of the body's copper, is called metabolically active copper and this fraction is exchanged between the various tissues of the body as needed. This metabolically active fraction is bound to either amino acids, peptides, or proteins. This fraction is high in healthy people but diminishes in persons with inflammatory diseases such as arthritis.

Most of the body's copper is bound into proteins where it plays an important role in biological activities such as anti-oxidant effects, energy generation, tissue regeneration and so forth.

Confusion over Blood Copper and Disease States

Blood serum copper is about 5% metabolically active copper; the other 95% being in the anti-oxidant protein ceruloplasmin. During many diseases and stress conditions, the body increases ceruloplasmin levels as a protective anti-oxidant mechanism. Because metabolically active copper is technically difficult to measure, most studies of copper and disease states reported only the total blood serum copper. This has caused much confusion and often has led to false conclusions as to the role of copper in disease states.

For example, total blood plasma copper is elevated in diseases such as cancer, heart disease, and arthritis but this increase is due to increased ceruloplasmin in the blood. Some misinformed persons have interpreted this increase in blood copper to indicate that high copper causes these conditions and diseases. But when copper supplements are given to animals or humans, the additional dietary copper has been found to lower carcinogenesis and tumor growth, inhibit the development of cardiovascular problems, and reverse many arthritic effects. See more below.

Should dietary copper intake be raised to reduce major diseases?

Some experts on copper are of the opinion that copper intake should be raised. Copper deficiency diseases are virtually the same as the pattern of major diseases in the USA. This suggests that some of these diseases may be partially due to inadequate copper in our diet.

Copper toxicity is a rarity and most experts consider a daily intake of 10 milligrams to be safe. However, since copper and zinc compete for uptake in the body, a high copper intake reduces zinc absorption, and, conversely, a high zinc intake reduces copper uptake. Thus, a balance should be maintained between these to metals. Most commonly, nutritionists recommend a ratio of 7 parts by weight zinc to one part copper.

There Are No Adequate Studies on Toxic Levels of Copper in Water

This is how the toxic level of copper in water was determined. A group of nurses had a party after which a number became ill. It was felt that the illness may have been due to the water they used. The water was analyzed and had a high level of copper. So this amount of copper in the water was divided by 4 and called the toxic level of copper in water. Whether the copper in the water caused the illness is still unknown.

When excess copper is ingested, within a range of 10 to 25 milligrams per day, the superfluous copper is excreted by the liver into the bile and copper balance is maintained.

The one condition where copper intake must be restricted is Wilson's disease, a rare genetic condition that affects 1,600 persons in the USA.

Uptake of Copper from Copper-Peptide products

Very little copper from copper peptide skin products penetrates through the skin. Charged molecules such as copper and peptides have very poor penetration of the skin and tests of copper peptide products have found that only about 0.1% or less of the copper passes through the skin. In contrast, fatty molecules penetrate the skin much more easily.

One small two-week study on Skin Biology's Protect & Restore cream found no changes in blood copper levels, or any other significant blood chemistry changes, when the product was applied twice daily (4 grams per day) for two weeks on six persons with irritated skin.

In summary, normal use of a copper peptide products might possibly result in a very small uptake of copper. For example, if one used 2 grams of product daily that contained 2 milligrams of copper, and if the skin uptake was at 0.1% penetration, this would introduce about 0.002 milligrams of copper into your body. If penetration through the skin was as high as 1%, your body uptake would still be about 0.02 milligrams or 1% of the RDA for copper.

Anti-oxidant Actions of Copper and Dietary Intake

The copper-containing protein, copper,zinc-superoxide dismutase (or CuZnSOD) is the primary anti-oxidant defense in the human body. Higher levels of CuZnSOD are a primary factor in longer lifespans in animals.

However, because copper 2 is usually in short supply in the human body, CuZnSOD has only about 50% of its needed copper (zinc supplies are usually adequate), and this markedly reduces CuZnSOD's anti-oxidant powers and is another reason why more dietary copper would be beneficial. Harris (Department of Biochemistry and Biophysics, Texas A&M University) pointed out that while copper,zinc superoxide dismutase requires two, copper and zinc, only copper, seems to regulate the expression of functional anti-oxidant activity. Restricting dietary copper quickly impairs the catalytic function CuZnSOD in numerous tissues. However, when diets are supplemented with copper, the CuZnSOD activity is quickly restored. (Harris ED, J Nutr, 1992, pp 636-40)

Under some biochemical circumstances, such as after traumatic tissue injury, copper (as well as other metals) can reverse its normal anti-oxidant role and cause damaging cellular oxidation. This has led some benighted amateur nutritionists to propose restricting dietary copper to reduce damaging oxidation in the body. But, controlled animals studies have found the opposite to be true: a reduced copper intake actually increases deleterious cellular oxidation and promotes a wide variety of the types of degenerative diseases associated with aging. On the other hand, a higher dietary copper intake in animals reduces overall damaging cellular oxidation.

It is true that there are damaging oxidative reaction in the human body. What is the answer to reduce destructive oxidation? First, do not worry too much about metal intake. People living in certain high mountain valleys of the world such as the Hunza area of Pakistan, the Vilcabamba area of Equador, the Caucasus of Georgia, Northwest Tibet, and Titicaca region in the Peruvian Andes, eat very different diets but all drink water with a very high mineral content (hard water from glaciers) but the lifespan and health of the elderly in these regions is exceptional high. In contrast, regions with low mineral water (soft water) are characterized by high rates of cancer and heart disease.

One analysis of drinking water in the Hunza valley found a zinc to copper ratio of 1.8. This far lower than the normally recommended ratio of 7.0 and also suggests a higher intake of copper might be beneficial.

Daily fruit juice reduces lipid peroxidation by 75%

Also, to reduce damaging cellular oxidation in your body, use other anti-oxidants such as coenzyme-Q10, alpha lipoic acid, vitamin E isomers, and melatonin. These help protect the polyunsaturated fats in cellular membranes.

Plus take in substantial amounts of fresh fruits and vegetables that are rich in many types of important anti-oxidants. We are descended from primates who lived on a diet that consisted of about 97% fresh plant foods.

One study found the daily intake of dried extracts of fruits and vegetables to reduce lipid peroxidation products in the blood by 75% within one week. Lipid peroxidation products are an excellent measure of rate damaging oxidation within the body.

In the study, fifteen healthy adults (10 women, 5 men; ages 18 to 53 years) consumed the supplements twice daily for 28 days. The fruit and vegetable supplements consisted of dried fruit and vegetable powders obtained by drying juices from apples, oranges, pineapples, papaya, cranberries, and peaches, carrots, parsley, beets, broccoli, kale, cabbage, spinach, and tomatoes. Each person received gelatin capsules containing 850 mg of fruit powder per fruit and 750 mg of vegetable daily.

After 7 days the lipid peroxidation products were reduced by 75% and remained low until the end of the trial. At 28 days the starting lipid peroxides in the serum of 16.85 ± 16.91 µmol/mL were reduced to 4.22 ± 3.78 µmol/mL. During the 28 days serum antioxidant levels increased significantly: beta-carotene, 510%; alpha-carotene, 119%; lutein/zeaxanthin, 44%; lycopene, 2046%; and alpha-tocopherol, 57%. (J. Wise , R. Morin , R. Sanderson , and K. Blum, Changes In Plasma Carotenoid, Alpha-Tocopherol, And Lipid Peroxide Levels, Changes In Plasma Carotenoid, Alpha-Tocopherol, And Lipid Peroxide Levels In Response To Supplementation With Concentrated Fruit And Vegetable Extracts: A Pilot Study, Current Therapeutic, Vol. 57, June 1996).

Expected effects of various copper/zinc ingestion patterns		
Regimen	**Losses**	**Gains**
Reduce copper and zinc	**Lose main anti-oxidant defense, Less active CuZnSOD, Energy production drops, Immune system defects, More degenerative disease**	
Adequate copper and zinc		**Strong main anti-oxidant defense, Active CuZnSOD, Good Energy production, Strong Immune system, Less degenerative disease,**
Reduce copper and increase zinc	**Lose main anti-oxidant defense, Less active CuZnSOD, Energy production drops, Immune system defects, More degenerative disease**	
Adequate copper and zinc plus alpha lipoic acid, Co Q-10, Melatonin, vitamin E isomers and high fresh fruit/vegetable intake		**Strongest anti-oxidant defense, Active CuZnSOD, Best protection of fragile lipids, Good Energy production, Strong Immune system, Less degenerative disease**

Copper may reduce some cancers

The Center for Disease Control states that "Copper has not been shown to cause cancer in people or animals". The International Agency for Research on Cancer has determined that copper is not classifiable as to human carcinogenicity. Added copper complexes reduce spontaneous colon cancer in rats and, when administered to tumor-bearing rats, slow the rate of tumor growth. In cell culture, copper complexes cause some types of cancer cells to revert to non-cancerous growth patterns.

In 1912, cancer patients in Germany were treated for facial epithelioma with a a blend of copper chloride and lecithin with some success. In 1913, researchers at at the University of Liverpool reported injections of a copper salt degenerated carcinomas transplanted into mice.

John R. J. Sorenson (University of Arkansas for Medical Sciences, College of Pharmacy) and colleagues treated rats with solid tumors with various copper complexes (such as copper salicylate) with SOD activity and this decreased tumor growth and increased survival rates in rats. These copper complexes did not kill cancer cells but often caused them to revert to the growth patterns of normal (differentiated) cells. (Sorenson, Prog Med Chem 1989; 26: 506-507) Sorenson also found that numerous copper complexes with SOD activity prevented or retarded the spontaneous development of cancers in mice and possessed anticancer, anti-carcinogenic, and anti-mutagenic effects both in vitro and in vivo. (Sorenson (ed.), Biology of Copper Complexes. Humana Press, Clifton, NJ. 1987)

The serum level of copper is often elevated in animals and humans with cancer (Inutsuka and Araki, Cancer 1978; 42: 626; Willingham and Sorenson, Tr Elem Med 1986; 3: 139-140.) It appears that this elevation of serum copper that occurs as a part of the body's response to the cancer, rather than its cause. Most tumor cells have decreased CuZnSOD activity compared to normal cells, and it has been suggested that the elevation in serum copper is a physiological response designed to activate CuZnSOD or other copper enzymes in cancer cells to inhibit their growth. (Oberley and Buettner, Cancer Res 1979; 39: 1141).

Colon cancer is the second most deadly cancer in the USA. When rats were fed low copper diets, they had a higher incidence of carcinogen-induced colon cancers compared with rats fed a high copper diet. (DiSilvestro, Greenson, Liao, Proc Soc Exp Biol Med 1992; 201: 94-99).

Also, APC is a gene known to suppress the formation of tumors and this gene is altered early on during colon cancer development. Familial adenomatous polyposis is a disease that has been linked to mutation changes in the APC gene. Individuals possessing these mutations develop numerous intestinal polyps (precancerous lesions) at an early age. A species of mice (Min or

multiple intestinal neoplasia) have a mutation similar to the human gene (APC) that causes intestinal polyps and colon cancer. A study reported in 2001 by nutritionist Cindy D. Davis at the Human Nutrition Research Center (Grand Forks, N.D.) found that, when Min mice were fed a copper deficient diet (20% of normal level), they developed a significantly higher small intestine tumor incidence and a significantly higher small intestine tumor mass than mice fed adequate dietary copper. The low copper also decreased the expression of various protein kinase C isozymes, a series of proteins involved in the signal transduction pathway within the cell, thus upsetting normal cell regulation. Dr. Davis says these results have implications because 80% of the people in the USA do not ingest adequate amounts of copper.

Another study of copper deficiency in animals by Narayanan, Fitch and Levenson found that copper stimulates the production of the tumor-suppressor protein p53. This protein inhibits the growth of tumors in the body. (Narayanan, Fitch and Levenson, Dept. of Nutrition, Florida State U., Tallahassee, FL in The Journal of Nutrition, May 2001)

Copper and Cardiovascular Disease

Humans and animal studies demonstrate that copper deficiency increases the plasma cholesterol and LDL-cholesterol while decreasing HDL-cholesterol, thus increasing the cardiovascular disease risk. (Klevay, Inman, Johnson, et al, Metabolism 1984; 33: 1112-1118. Klevay, Med Hypothesis 1987; 24: 111-119; Klevay, Med Hypothesis 1987; 24: 111-119).

Klevay theorized that a metabolic imbalance between zinc and copper, but more a copper deficiency than zinc excess, is a major factor in the genesis of coronary heart disease. (Klevay, Lack of a recommended dietary allowance for copper may be hazardous to your health. Journal of the American College of Nutrition. 1998; volume 17: pages 322-326) Other investigators found that copper complexes also can minimize damage to the aorta and heart muscle following myocardial infarction.

Severe copper deficiency results in heart abnormalities and damage (cardiomyopathy) in some animals. (Institute of Medicine. Dietary reference intakes for vitamin A, vitamin K, boron, chromium, copper, iodine, iron, manganese, molybdenum, nickel, silicon, vanadium, and zinc. Washington, D.C.: National Academy Press. 2001: pages 7-1-27)

A multicenter placebo-controlled study found copper supplementation with 3 or 6 mg/day increased the resistance of red blood cells to damaging oxidation indicating that relatively high intakes of copper do not increase the susceptibility of LDL or red blood cells to oxidation. (Rock, et al. The effect of copper supplementation on red blood cell oxidizability and plasma antioxidants in middle-aged healthy volunteers. Free Radical Biology and Medicine. 2000; volume 28: pages 324-329; Turley, et al. Copper supplementation in humans does not affect the susceptibility of low density lipoprotein to in vitro induced oxidation. Free Radical Biology and Medicine. 2000; volume 29: pages 1129-1134)

Rats on a copper deficient diet had a decrease in aortic integrity that produces eventual aneurysm. (Greene, et al, J Surg Res 1987; 42: 503-512)

Immune system function

A medical publication in 1867 reported that, during the cholera epidemics in Paris of 1832, 1849 and 1852, copper workers did not develop cholera. Another observation was that persons with Menke's disease died from frequent and severe infections due to an inadequate immune response. Menke's is an inherited disease causing defective copper absorption and severe copper deficiency. (Percival, Copper and Immunity. American Journal of Clinical Nutrition. 1998; volume 67: pages 1064S-1068S; Failla and Hopkins, Is low copper status immunosuppressive? Nutrition Reviews. 1998; volume 56: pages S59-S64)

Studies with animals demonstrated that animals deficient in copper had an increased susceptibility to bacterial pathogens such as Salmonella and Listeria. (Bala and Failla, Proc Natl Acad Sci USA 1992; 89: 6794-6797) A study of 11 infants with copper deficiency found that the ability of their white blood cells to engulf pathogens increased after one month of copper supplementation (Heresi, et al. Phagocytosis and immunoglobulin levels in hypocupremic children. Nutrition Research. 1985; volume 5: pages 1327-1334) A study of adult men on a low-copper diet (0.66 mg copper/day for 24 days , then 0.38 mg/day for another 40 days) showed a decreased ability of mononuclear cells to respond to antigens. (Kelley, et al. Effects of low-copper diets on human immune response. American Journal of Clinical Nutrition. 1995; volume 62: pages 412-6.) Abnormally low numbers of white blood cells is a clinical indicator of copper deficiency in humans and functioning of macrophages decreases in even marginally copper deficient rats . (Babu and M.L. Failla, J Nutr 1990; 120: 1700-1709)

Some studies have suggested that immune function and neutrophil activity is more sensitive to low dietary copper than standard measures of copper status. Immune impairment can be detected by one week after the start of a diet low or marginal in copper; conversely, the addition of adequate copper rapidly reverses the immune suppression within one week. Copper deficiency also reduced DNA synthesis in activated T-cells but this is also quickly reversible after copper supplementation. (Bala and Failla, Proc Natl Acad Sci USA 1992; 89: 6794-6797)

It has been suggested that, because the immune system is very sensitive the changes in the body's copper status, it may be possible to set a scientific RDA (Recommended Daily Allowance) for copper by giving persons graded amounts of dietary copper and then determining the optimal copper dosage for optimal immune function. (Babu and Failla, J Nutr 1990; 120: 1700-1709)

Copper, Inflammation, and Arthritis

Studies of rheumatoid arthritis and copper exemplify the paradoxes that have so confused research on copper and its effects on various diseases.

In 1885, the French physician, Luton, used copper acetate to treat arthritic patients. He made a salve of hog's lard and 30% neutral copper acetate for application to the skin over affected joints. He also had his patients take pills containing 10 mg. of copper acetate per day.

In 1939, the German physician, Werner Hangarter, wrote that Finnish copper miners remained free of arthritis while they worked in the mining industry. This was notable since rheumatism was widespread in Finland. This finding led Finnish medical researchers to treat patients with a mixture of copper chloride and sodium salicylate. They reported treatment successes in patients suffering from rheumatic fever, rheumatoid arthritis, neck and back problems, and sciatica.

Between 1940 and 1970, studies of persons with rheumatoid arthritis found them to have higher than normal serum copper levels. Similar results were found in other various inflammatory diseases in man and animals. (Lewis, Agents and Actions 1984; 15: 513-519) Yet, in seeming contradiction, copper complexes were successfully used in the treatment of numerous conditions characterized by arthritic changes and inflammation. (Sorenson and Hangarter, Inflammation 1977; 2: 217-238) But this use of copper complexes was superseded by the development of anti-inflammatory steroids and aspirin-like nonsteroidal anti-inflammatory drugs in the treatment of these conditions.

Subsequent researchers examined this paradoxical role of copper, and they concluded that increase in serum copper is a physiological response to inflammation, rather than a cause of inflammation. (Sorenson, J Pharm Pharmac 1977; 2: 450-452) The rise in serum copper is due to an elevation of the protein ceruloplasmin in serum, but ceruloplasmin has strong anti-inflammatory activity and tends to counteract the inflammatory state. (Frieden, Clin Physiol Biochem 1986; 4: 11-19) Further research established that copper deficiency increased the severity of experimentally-induced inflammation. (Sorenson and Kishore, Tr Elem Med 1984; 1: 93)

Professor John R. J. Sorenson (University of Arkansas for Medical Sciences, College of Pharmacy) has led the scientific work on the use of copper complexes to treat patients with arthritic and other chronic degenerative diseases. He has found that the copper complexes of over 140 anti-inflammatory agents, such as aspirin and ibuprofen, for example, to be far more active than these compounds without copper. Copper aspirinate has been shown to be more effective in the treatment of rheumatoid arthritis than aspirin alone. It also has been shown to prevent or even cure the ulceration of the stomach often associated with aspirin therapy. Sorenson has reviewed a wide variety of of copper complexes that have potent anti-inflammatory activity when administered to humans or animals; his review is 110 pages long and with a bibliography of 736 references. (Sorenson, Prog Med Chem 1989; 26: 437-568)

Copper and Osteoporosis

200 years ago, the German physician Rademacher established that copper supplements speeded the healing of broken bones in patients. (Dollwet and Sorenson, Tr Elem in Med 1985; 2: 80) In the years that have followed, compelling evidence has established a vital role for copper in the biosynthesis of bone and connective tissues and their maintenance.

Inadequate dietary copper causes osteoporosis in numerous animal species and humans. (Dollwet and Sorenson, Biol Tr Elem Res 1988; 18: 39-48) Copper deficiency is associated with scoliosis, skeletal abnormalities, and increased susceptibility to fractures. (Worthington and Shambaugh, J Manipulative Physiol Ther 1993; 16: 169-173) Danks. Copper Deficiency in Humans. In: "Biological Roles of Copper." CIBA Foundation Symposium-79. Exerpta Medica, Amsterdam, 1980. p. 209) Inadequate dietary copper lowers bone calcium levels. (Strause, P. Hegenauer, R.C. Saltman, et al, J Nutr 1986; 116: 135)

One study of elderly persons found a decreased loss of bone mineral density from the lumbar spine after copper supplementation of 3 milligram daily for 2 years (Conlan, et al. Serum copper levels in elderly patients with femoral neck fractures. Age and Aging. 1990; volume 19: pages 212-214)

Healthy adult males on a low copper intake of 0.7 milligrams daily for 6 weeks exhibited an increased rate of bone resorption (breakdown). (Baker. et al. Effect of dietary copper intakes on biochemical markers of bone metabolism in healthy adult males. European Journal of Clinical Nutrition. 1999; volume 53: pages 408-412)

Copper and DHEA

DHEA (dehydroepiandrosterone) is a key hormone that produces mainly secondary hormones and counter's the damaging actions of cortisol during stress. It is widely used as a dietary supplement to help prevent deleterious changes with age. Klevay and Christopherson found that copper deficiency in rats decreased DHEA in serum by approximately 50%. The authors suggest that eating a diet higher in copper will increase the DHEA level in the body. (Klevay and Christopherson, Society Of Experimental Biological Medicine Proceedings, 1999)

Copper and Pregnancy

In the 1930's at a sheep station in Western Australia many newborn lambs were uncoordinated, had difficulty standing, and died. Later, it was determined that the pregnant sheep were pastured on land that produced grass with a very low copper content. This herbage did not provide enough copper for normal development of the lambs' nervous system and the brain.

Recent research at the USDA's Grand Forks Human Nutrition Research Center found that even marginal copper deficiency in pregnant rats produces brain damage and neurological defects in their offspring. The newborn rats have

structural abnormalities in the areas of the brain involved in learning and memory and responsible for coordination and movement. These produced further behavioral changes and the young rats lack the normal "startle" reflex to unexpected noises. This deficit permanently affected the young rats and could not be correct by diets higher in copper.

During pregnancy, a sufficient copper intake is essential for normal neurological development of the fetus. Tom Johnson, Ph.D., lead author of the study said "A reserve of copper is built up in the liver during fetal development that helps satisfy the requirement of the newborn for copper. Thus, adequate copper intake during pregnancy is important to ensure the fetus acquires sufficient copper to fill this reserve. However, for the health of the mother, she should have a copper intake of 1.5-3.0 mg/d postpartum and during lactation."

Small deficits in dietary copper produce substantial changes in fetal brain enzymes. Protein kinase C (PKC) is a copper-dependent enzyme that is crucial in the development of the nervous system. The PKC levels were measured in the brains of rat pups whose mothers had been fed a copper-deficient diet during and for a few weeks after pregnancy. The diet was defined as 1 mcg/d for one group and 2 mcg/d for a second group of rats (one third of the recommended copper), while the control group received sufficient dietary copper. While PKC levels rose in all the rat groups during the three weeks after birth, the increase was only half as much in the group whose moms got 1 mcg/d, and 25% less in the 2mcg/d group. Moreover, at 2 mcg/d, one form of PKC was off by 50% in the cerebellum, which happens to be the control center for motor function and muscle coordination.

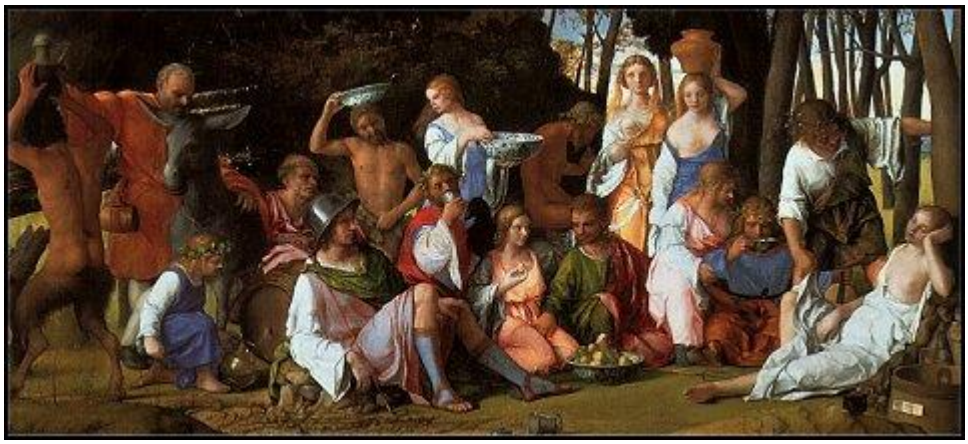
Another study from the University of California at Davis reported that that copper deficiency during pregnancy can result in "Numerous gross structural and biochemical abnormalities," which seem to arise as the copper deficiency reduces free radical defense mechanisms, connective tissue metabolism and energy production. The same researchers found that copper is better absorbed from breast milk than from infant formula. (Lonnerdal B., Copper nutrition during infancy and childhood. Am J Clin Nutr 1998 May;67(5 Suppl):1046S-1053S.)

Pregnant women (and others) can obtain copper from supplements and seafood, oysters, liver, nuts and seeds, beans, whole-grained bread, cocoa, chocolate.

Anticonvulsant Activities of Copper Complexes

The brain contains more copper than any other organ of the body except the liver, where copper is stored for use elsewhere. This fact suggests that copper plays a role in brain functions. With reports of seizures in animals and humans following the protracted consumption of copper-deficient diets, it was reasoned that copper has a role to play in the prevention of seizures. It was subsequently discovered that organic compounds that are not themselves anti-convulsants exhibit anticonvulsant activity when complexed with copper.

Further, it was found that copper complexes of all anti-epileptic drugs are more effective and less toxic than their parent drugs. (J.R.J. Sorenson, Prog Med Chem 1989; 26: 437-568.)



Is Longevity in France Due to Copper in Wine and Cooking Pots?

Citizens of France are blessed with exceptional healthy lives; they are some of the longest lived people on earth and have very low rates of heart disease despite eating a diet of great tasting foods that are high in fat. Some have speculated that the low heart attack rate in France compared to the rest of Europe is because of the heavy drinking of red wine in France. The copper in red wine comes from the skin of the grape which has copper retained from the copper sulfate used by French vintners on the grapes. Red wine has about 0.2 milligrams of copper per liter. (Dollwet and Sorenson, Historic uses of copper compounds in medicine, Trace Elements in Medicine, Vol. 2, No. 2, 1985, pp 80- 87)

At first calculation, the intake of copper from wine does not seem adequate to markedly increase the daily intake of copper - one liter of wine daily would supply only about 0.2 milligram of copper and this is only 10% of the commonly recommended RDA. It is possible that wine increases copper uptake into the body. But normally only about 30% of ingested copper is taken into the body because of copper binding actions of plant foods. However, one study compared copper levels in chronic alcoholic patients without clinical signs of hepatic failure and normal healthy persons. It was found that the the alcoholic group had significantly elevated serum copper levels. (do Carmo M das G, Instituto de Nutricion y Tecnologia de los Alimentos, Florianopolis, Brasil, Niveis sericos de zinco e cobre e atividade da superoxido dismutase eritrocitaria em pacientes alcoolatras (Serum levels of zinc and copper and erythrocyte superoxide dismutase activity in alcoholic patients), Arch Latinoam Nutr, Mar 1988, 38 (1) p81-92)

Another source of dietary copper in France may be the use of copper cooking pots. While most pots are lined with tin or stainless steel, unlined copper pots work best for egg whites. Zabaglione is one of the recipes most commonly made in an unlined copper pan. Unlined copper is also widely used in the candy industry and copper pots help to make candy thicker. Confectionery prepared in unlined copper takes advantage of the rapid, high heat needed to make candy.

Julia Child who wrote "Mastering the Art of French Cooking", which was syndicated on TV for many years, insisted that the proper way to make a French omelet was with eggs, a pan, a copper bowl, and a whisk. She wanted to show the world how to make a proper omelet -- the French way.

Copper pots also inhibit bacteria growth. Cultures of the bacteria, E. coli survived for 34 days on a stainless steel surface but lasted only 4 hours on a copper surface in a British study. Research at the University of Chile suggests that copper halts the growth of Salmonella and Campylobacter. Campylobacter food poisoning hits about two million people in the USA and another 40,000 become ill from Salmonella. Tiny scratches in metal pots can trap bacteria and are difficult to clean. But copper pots kill such bacteria. (Faundez, G. & Figueroa, G., Evaluation of antibacterial activities of copper surfaces against Salmonella enterica and Campylobacter jejuni isolated from foods, University of Chile, 2001).

"The Turn Back the Clock Doc", **Loren Pickart has spent his life working on methods to reverse the effects of aging in the human body and is the discoverer of the human skin and tissue remodeling copper-peptide, GHK-Copper. Skin remodeling copper peptides are the body's natural signals that repair and restore damaged and aged tissue by (1) inducing strong anti-inflammatory actions (activate superoxide dismutase and decrease damaging actions of TGF-beta and interleukin-1), by (2) stimulating the removal of damaged and older skin by increasing the synthesis of metalloproteinases, and (3) by increasing the generation of new collagen, elastin, proteoglycans, and rebuilding the microcirculation and by increasing production of new skin cells. He and his wife, Charlene, worked to start ProCyte Corporation in 1985 to develop his first generation of GHK-Copper products and Skin Biology in 1994 to create a second generation of more effective, skin remodeling copper peptides.**

Products based on Pickart's inventions and GHK-Copper have been marketed by AdviCare, American Crew, Amuchina (Europe), Atelier Esthetique, Bard Medical, BioPharm (Middle East), Creative Nail Design, Johnson & Johnson, Schering AG, Neutrogena, Osmotics, ProCyte, Sigmacon Medical Products (Canada) and Tanox Biosystems (Asia). These include products for Cosmetic Skin Renewal: Neutrogena Visibly Firm Night Cream®, Neutrogena Visibly Firm Eye Cream®, Neutrogena Visibly Firm Moisture Makeup®, Neutrogena Visibly Firm Eye Treatment Concealer®, Neutrogena Visibly Face Lotion®, Neutrogena Visibly Firm Body Lotion®, Visibly Firm Face Lotion SPF 20®, Blue Copper Firming Elasticity Repair®, Climate Extreme Body Repair with Copper

Peptide®, Simple Solutions® **products (Pure Copper Night Renewal®, Pure Copper Morning Dew®, Ultra Copper Firming Serum®, Pure Copper Eye Repair®, Men Pure Copper® After Shave Moisturizer, Men Pure Copper® Eye Repair), NextDerm Revitalizing Serum®, NextDerm Firming Cream, NextDerm Eye Lift Creme®, NextDerm Microdermabrasion Skin Polisher®, Blue Razor Aftershave®, Neova® Eye Therapy, Neova® Night Therapy Creme®, Neova® Day Therapy, Neova® Body Therapy Lotion®, Neova® Cuticle Therapy, Neova® Antioxidant Therapy Serum with GHK Copper Peptide Complex(TM), Neova® Cuticle Therapy, Neova® Therapy Cleansing Bar, Neova® Therapy Mattifying Serum, Neova® Therapy Copper Moisture Mask®, Neova® After Shave Therapy, Neova® Body Scrub, Neova Creme De La Copper®, Neova® Therapy Dual Action Lotion; Nu Glow® Copper Peptide Serum, Nu Glow® Copper Peptide Eye Therapy, Nu Glow® DayTime Therapy, Nu Glow® Copper Peptide NightTime Therapy; for Veterinary Wound Healing: Iamin-Vet Skin Care Gel® and Iamin-Vet Wound Cleanser®. for Wound Healing: Iamin Gel Wound Dressing®, Iamin Impregnated Gauze Dressing®, Iamin Wet Dressing (copper-saline)®, Iamin-2 Hydrating Gel®, and Iamin Wound Cleanser®; for Hair Transplantation and improving the success of hair transplants: GraftCyte® Advanced Hair Restoration Technology: GraftCyte® Concentrated Spray, GraftCyte® Moist Dressings, GraftCyte® Hydrating Mist, GraftCyte® Post-Surgical Shampoo and Conditioner, and GraftCyte® Head Start Single Patient Pack; for Stimulation of Hair Growth and Hair Vitality: American Crew Revitalize Daily Shampoo®, American Crew Revitalize Spray Solution®, American Crew Revitalize Daily Conditioner®, American Crew Revitalizing Serum®, American Crew Revitalize Daily Moisture Shampoo®; Tricomin® Solution Follicle Therapy Spray, Tricomin® Revitalizing Shampoo, Tricomin® Restructuring Conditioner and Tricomin® Conditioning Shampoo; and for Post-Surgical Skin Healing after laser resurfacing, dermabrasion, and chemical peels: Complex Cu3® Intensive Repair Cream, Complex Cu3® Hydrating Gel, Complex Cu3® Post Laser Lotion, and Complex Cu3® Gentle Face Cleanser. In addition, human clinical studies of Pickart's inventions for bone healing and healing of intestinal irritations (Inflammatory Bowel Disease or Crohn's disease) have given positive results. He received his Ph.D. in Biochemistry from the University of California at San Francisco. For details on copper-peptide tissue remodeling - see:** Copper-Peptide Regeneration**.**