

A Doctor's Overview of Free Radicals and Four Synergistic Antioxidants

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THIS AUTHOR NOTES:

There is a constant battle going on inside our bodies.

The bad players are unstable molecules called **free radicals**.

The good players are molecules called **antioxidants**.

Free radicals begin with oxygen. When oxygen molecules have an unpaired electron in their outer shell, "they become very unstable and highly reactive."

Oxygen molecules that are lacking an electron in its outer shell can "aggressively attack other stable molecules and snatch away their electrons." When oxygen so steals electrons from other molecules, it is called **oxidation**.

Once the formerly stable molecules have their electrons stolen, they become free radicals themselves, causing a cascading chain reaction that damages and ages our bodies, leading to many health problems.

The body normally produces these harmful oxygen free radicals during the process of metabolism [the conversion of food (mostly glucose) and oxygen into ATP for energy].

Many free radicals also enter the body constantly from exogenous sources:

- 1) Air pollution
- 2) Cigarette smoke
- 3) Drugs
- 4) Pesticides
- 5) Exposure to ionizing radiation
- 6) Heavy metal exposure, including mercury, cadmium, lead
- 7) Alcohol consumption
- 8) Exposure to a variety of environmental chemicals

"Heavy exercise can produce higher quantities of free radicals." **[Important]**

Excessive exposure to free radicals can damage our DNA and DNA repair mechanisms, which can lead to cancer.

Excess free radicals also contribute to coronary atherosclerosis because they oxidize (steal electrons from) cholesterol, and oxidized cholesterol forms plaques.

[This is why some people can have high cholesterol and very low risk of cardiovascular events; they have lots of antioxidants that prevent their high levels of cholesterol from becoming oxidized and forming plaques].

Antioxidants minimize free radical damage by donating electrons to the free radical. This is called reducing [or reduction].

Our bodies produce its own endogenous antioxidants. They are enzymes. [All of our bodies are genetically different. Because our bodies make enzymes out of protein, and proteins are coded for in our DNA, each of us will genetically make different levels of our endogenous antioxidant enzymes].

Our three primary endogenous antioxidant enzymes are:

- 1) Superoxide dismutase
- 2) Glutathione peroxidase
- 3) Catalase

[Importantly, there is good evidence that low level laser therapy works in part because they upregulate (increase the activity of) the genes that produce these three endogenous antioxidant enzymes].

Destructive free radicals are also neutralized by exogenous antioxidants. [Exogenous antioxidants cannot be made by our bodies and therefore must be consumed].

The exogenous antioxidants are primarily vitamins, minerals, and herbs.

The four main exogenous antioxidants work together synergistically and form the mnemonic "ACES."

A for Vitamin A

Vitamin A, a fat-soluble vitamin that maintains healthy skin, vision (especially night vision), mucous membranes, immune system function, wound healing, sexual function, and has powerful antioxidant activity.

"Fully formed vitamin A is found naturally in animal food such as liver, fish oil, eggs, milk, cheese, and butter."

Too much vitamin A is toxic, and doses above 5,000–10,000 IU/day can cause "liver toxicity, nausea, deep bone pain, headaches, blurred vision, hair loss, dry skin, spleen enlargement, and birth defects."

Beta-carotene is converted by the body into vitamin A, and does not have the potential toxic effects of vitamin A.

Beta-carotene is found in dark green and yellow-orange vegetables and fruit such as carrots, sweet potatoes, spinach, broccoli, cantaloupe, squash, and mustard greens.

The usual supplementation intake for beta-carotene is 25,000–50,000 IU/day (15–30 mg/day).

Supplemental beta-carotene is usually synthetic and may increase the risk of lung cancer and blood vessel disease in heavy smokers, and enhance liver toxicity in alcoholics and heavy drinkers. Synthetic beta-carotene is listed as “beta-carotene.”

Consequently, this author recommends that one only supplement with natural beta-carotene. Natural beta-carotene is listed as “natural beta-carotene,” “from an algal source,” “from *D. salina*,” or “from a palm source.”

C for Vitamin C

Vitamin C is a powerful water-soluble antioxidant that is also important in collagen formation, wound healing, bile formation, alcohol detoxification, immune system enhancement, histamine destruction, cataract prevention, and vitamin E recycling.

Vitamin C can donate many electrons to free radicals, neutralizing their destruction of cytoplasmic molecules, including our DNA.

“Natural sources of vitamin C include citrus fruits, papaya, cantaloupe, chile peppers, tomatoes, broccoli, and other fruits and vegetables.”

“The chewable form of vitamin C should be avoided because its acidity can dissolve tooth enamel.” **[Important for our children]**

The optimal intake of vitamin C ranges from 200 mg/day to 500–1,000 mg/day.

E for Vitamin E

Vitamin E is a fat-soluble antioxidant that is important in anticoagulation, cataract risk reduction, coronary arterial disease risk reduction, atherosclerosis inhibition, glucose metabolism, inflammation control, and controls genetic aspects of cell division.

Vitamin E protects the fat-soluble constituents of the body from free radical damage, such as our cell membranes and cholesterol.

“Vitamin E is found naturally in wheat germ oil, nuts and seeds, whole grains, vegetable oils, peanuts, egg yolks, and butter.”

The recommended dose of vitamin E for maximum antioxidant activity is 100–800 IU/day. This level cannot be obtained from eating food and therefore supplements must be used.

The natural forms of vitamin E derived from vegetable oils and are designated with a "d," as in d-alpha tocopherol or d-alpha tocopheryl.

The synthetic forms of vitamin E derived from petroleum or turpentine and are designated with a "dl," as in dl-alpha tocopherol or dl-alpha tocopheryl.

This author prefers the natural form of vitamin E over the synthetic form, noting that the natural form is better absorbed and works better.

S for Selenium

The mineral selenium activates the endogenous antioxidant enzyme glutathione peroxidase. Selenium-glutathione peroxidase protects the body from many different cancers.

Selenium also activates thyroid hormones and promotes a healthy immune system.

Food grown in Washington, Oregon, California, Florida have very low levels of selenium.

One should never supplement with more than 400 µg/day of selenium, and levels above 900 µg/day are toxic, associated with loss of fingernails, hair loss, skin rash, neuropathy, nausea, vomiting, diarrhea, and fatigue.

Selenium is found naturally in Brazil nuts, yeast, seafood, and seeds and grains grown in soil containing selenium.

KEY POINTS FROM DAN MURPHY

- 1) Free radicals are molecules that have an unpaired electron in their outer shell.
- 2) The primary source of free radicals in our bodies is from breathing in oxygen and converting it into ATP energy. Therefore it is impossible to stop the generation of free radicals.
- 3) Other sources of free radicals are exogenous, including air pollution, cigarette smoke, drugs, pesticides, ionizing radiation, heavy metals (mercury, cadmium, lead), alcohol, and exposure to a variety of environmental chemicals.
- 4) Free radicals are very unstable. Free radicals become stable by pulling electrons away from other molecules, thus damaging the other molecule. Free radicals often pull electrons away from our DNA, damaging our DNA, which is related to cancer.

- 5) Oxygen free radicals are very strong, and can pull electrons away from nearly every other molecule in the body, damaging them.
- 6) Antioxidants are molecules that readily give oxygen free radicals electrons so that the free radical will not need to pull electrons off of other molecules damaging them. Therefore, antioxidants protect us from free radical damage.
- 7) This author lists two categories of antioxidants:
 - A)) Endogenous antioxidants. These are enzymes that are produced by our own DNA. There are three: Superoxide dismutase, Glutathione peroxidase and Catalase.
 - B)) Exogenous antioxidants. These are compounds, mostly vitamins, minerals, and herbs that we must consume because our bodies cannot make them. They must be in our diets or supplemented. The three main exogenous antioxidants are "ACES": vitamin A, vitamin C, vitamin E, and selenium.
- 8) Strenuous prolonged exercise produces significant higher levels of free radicals. Strenuous prolonged exercisers should consume much higher doses of exogenous antioxidants to protect their bodies from the excess free radicals.
- 9) The most dangerous cholesterol for cardiovascular risk is cholesterol that has been damaged by free radicals (oxidized by free radicals).
- 10) Natural forms of antioxidant supplements are superior over the synthetic forms.

ADDITIONAL COMMENTS FROM DAN MURPHY

Again, there is good evidence that low-level laser therapy works in part because they upregulate (increase the activity of) the genes that produce the three endogenous antioxidant enzymes, superoxide dismutase, glutathione peroxidase and catalase.

Equally importantly, the endogenous antioxidant enzymes require minerals to effectively neutralize destructive free radicals. Superoxide dismutase requires Zinc, Copper, Manganese. Glutathione peroxidase requires Selenium.

The incredible effectiveness of low-level laser therapy is further enhanced by supplementing with a balance of zinc, copper, manganese, selenium, and riboflavin (which recharges depleted glutathione). Such a product has been developed by Nutri-West. It is called **Laser Minerals**. **Laser Minerals** can also be topically applied to the skin with the Nutri-West product Laser Ice. **Nutri-West's** phone number is **(800) 443-3333**.