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Antioxidants; The Power of Life;

Electricity is the term used to describe the flow of electrons down a wire or other conductive medium. While that may be fascinating, what does it have to do with Anti-oxidants and the power of life? Good question, glad you asked!

Electron flow is also what keeps every cell in our bodies alive, indeed, it is one of the essentials of life. Since we are not made of conductive materials, how does this flow happen?

Students of Medicine, Biology, and Biochemistry are familiar with the Ebden-Meyerhoff (Glycolytic/anaerobic) and Krebb's (Tricarboxylic acid/aerobic) pathways. There are varieties of enzymes that break glucose and fats down to extract their energy. This energy is converted to Adenosine Tri-Phosphate (ATP), which is what powers all of the systems in each cell of our body. One of the side effects of this process involves the production of "free radicals". Free radicals are extremely reactive—this means that they will interact with every atom and molecule in the area and potentially destroy them. It's a double-edged sword that either keeps us alive or kills us. These reactions are kept in check and under control by anti-oxidants.

Let's review basic chemistry for a moment; "oxidation" is the term to describe taking electrons from an electron donor to the recipient molecule that undergoes "reduction" which is the addition of electrons. Protons or hydrogen ions follow the electrons as they move to maintain chemical balance. Typically there is an electron donor paired with an electron recipient. In the case of cellular respiration, each step of the pathways above generates energy, which is converted to ATP. As we discuss the antioxidants, it's important to recognize that there is a chain of reactants, the electron donor, the recipient which will then become a donor to the next recipient to safely control the flow of this energy and minimize damage caused by the free radicals to our hardware—intracellular organs. When working with antioxidants there is a critical concept to be aware of; any of the antioxidants can become a "pro-oxidant" and thus cause damage to the systems involved. It's important to remember that antioxidants need to be given in combination, using exclusively one antioxidant in high doses can cause problems due to this pro-oxidant effect. Certain of the antioxidants work in a given area of the cell or best perform certain types of reactions. They may be able to reduce/oxidize other substances as well but they have their preferred substrates ("targets"). Antioxidants are compounds that are present in the body to provide protection against this double-edged sword. There are two main classes of antioxidants; Intrinsic enzyme antioxidants such as superoxide dismutase, catalase and peroxidase. Extrinsic antioxidants include nutrients from foods, vitamins, minerals and herbs¹.

Intrinsic antioxidants include the enzyme systems mentioned above. Another key component is "glutathione". In it's reduced state, this is a short-chain of the amino acids; L-cysteine, L-glutamic acid and L-glycine. When taken orally it tends to be broken down by the gut and not work well. It can be given directly intravenously or as a lyophilized liquid form taken under the tongue. The precursors can also be taken, N-acetyl cysteine (NAC) at 500 mg three times daily can help replenish glutathione levels. Vitamin C/ascorbic acid has many important functions in the body. Linus Pauling PhD received the Nobel Prize for his work on the structure and function of DNA. After winning the prize, he spent the rest of his professional career studying this amazing molecule. Among the functions of Vitamin C are synthesis of collagen—the linear protein that holds us together, iron absorption, immunity, cataract prevention, reduction of oxidized Low-Density Lipoprotein (LDL—the "bad" cholesterol), and regeneration of Vitamin E & beta carotenes. There is no clear ceiling on dosing for Vitamin C. Humans are about the only mammals that don't have the last of the four enzymes needed to make Vitamin C. [L-gulonolactone oxidase](#), cannot be made by the listed animals because the gene for this enzyme, [Pseudogene ΨGULO](#), is defective². Goats make up to 20,000 mg of this substance daily and can eat almost anything. It's quite likely that the arbitrarily assigned Recommended Daily Allowance from the FDA is to low for humans.

Vitamin E/tocopherols is a fat-soluble vitamin that provides cardiovascular protection, reduces risk of cancer, cataract, macular degeneration, skin problems, erectile dysfunction, Alzheimer's, Multiple Sclerosis, menopausal discomfort and chronic inflammatory disease. Being fat-soluble, it dose most of its work in cell membranes. Doses of 400-800 mg/d are used.

Carotenoids/Vitamin A & beta Carotenes are both fat and water soluble compounds involved in cancer protection, heart disease, immune support, eye diseases, reduce risk of diabetes, Alzheimer's, sunburn & exercise induced asthma. Dosage is generally 5,000 units/d for Vitamin A and up to 25,000 units of Vitamin A activity in the carotenoids.

Bioflavenoids enhance vitamin C absorption; have anti-inflammatory, antihistamine, antiviral effects as well as providing protection to blood vessels and reduction of oxidized insoluble LDL cholesterol. They are dosed at 50-200 mg/d.

Soy isoflavones/Genistein improve circulation and protect against Alzheimer's disease, dosage is typically 200-400 mg twice daily.

Quercetin is potentially protective of cancer, its dosed at 200-400 mg two to three times daily.

Ginkgo biloba 60-120 mg twice daily also helps prevent Alzheimer's disease

Alpha Lipoic acid is both fat and water-soluble; it is a universal antioxidant that benefits cellular metabolism and energy production. It enhances antioxidant functions of Vitamin s C, E, Glutathione and may prevent diabetic complications, glaucoma and cirrhosis of the liver. Doses of 150-800 mg in daily to divided doses throughout the day are used.

CoEnzyme Q10 (ubiquinone) is vital to the heart's function, it protects against angina, arrhythmias, congestive heart failure, hypertension. Also an immune system stimulant strengthens gums, protects nerves and aids in the generation of ATP within the mitochondria. People who have muscle aches while taking statin type drugs for high cholesterol can get relief of the pain by taking supplemental CoQ10 indicating that these folks have a genetic predisposition for interruption of CoQ10 synthesis when these medications are taken. Doses can go up to 400 mg daily.

Selenium is a water soluble mineral number 34 on the periodic table of the elements. It helps prevent cancer, heart disease, degenerative eye disorders, thyroid hormone production, cold sores and shingles. Dosing is 100-400 mcg daily.

It's important to re-emphasize that the antioxidant agents listed above can actually become "pro-oxidants" making damage to your cells more likely if they are not taken in concert with the other members of the team discussed above.

The antioxidant series of compounds are also essential in or body's ability to detoxify or rid itself of free radicals and poisons and other harmful agents. Overdose of certain drugs such as Acetaminophen (Tylenol) is treated by giving large doses of NAC to allow the liver to clear itself of the lethal overdose and allow us to survive.

More inflammation is available in the library section of our website; www.tequestafamilypractice.com .

¹ Rakel, D; Integrative Medicine, 1st Edition, Philadelphia PA, Saunders Press, 2003, p 735

² Harris, J. Robin (1996). *Ascorbic Acid: Subcellular Biochemistry*. Springer. pp. 35. [ISBN 0306451484](https://www.isbn-international.org/view/title/0306451484). [OCLC 34307319 46753025](https://www.worldcat.org/oclc/3430731946753025)