ROSMARINIC ACID  More Than Just an Antioxidant

At times the free radical story seems like old news. Everyone knows these harmful molecules cause wrinkles, aging and heart disease—even cancer. But how much do we really understand? Where do they come from and exactly how much of a risk do they pose?

Far from clarifying these issues, recent discoveries in the field of free radical biology have complicated the picture even more. There are many free radicals and your body is attacked by trillions of them every day—every hour if you’re a smoker. They’re a formidable opponent but we’re not defenseless. Antioxidants can neutralize free radicals, although most people using them don’t understand how. So are all antioxidants as good as one another? If not, what’s the difference? Perhaps specific antioxidants are needed to neutralize specific free radicals. How many do we need? Do they interact with each other? Are there side effects?

Even though there are more questions than answers, North Americans today consume antioxidant pills and powders in unprecedented quantities. We owe it to ourselves to get better acquainted with free radicals and antioxidants. Years ago we heard that antioxidants would herald the dawn of a new age in preventive medicine. Since then science has made impressive headway into this new age. Since the key to preventive medicine is self-knowledge, we can benefit by understanding the mechanisms of free radical damage and the antioxidant defense system. This understanding can also help us recognize the significance of new antioxidants such as rosmarinic acid (RA).

What are free radicals?
Free radicals are damaged atoms or molecules that cause untold harm to the body. This happens by the same process that turns oat rancid. The worst-case scenario is lipid peroxidation, when the molecules in the fatty walls of cells are ignited like firecrackers, losing and stealing electrons in chain reactions that quickly damage the entire cell.

It all has to do with atomic electricity. According to quantum chemistry, the electrons that surround all atoms have a natural tendency to pair off and counterbalance one another—one with an “up-spin” and the other with a “down-spin.” Atoms with an uneven number of electrons usually pair them off with available electrons in other atoms, forming strong bonds that hold the atoms together as molecules. Most electrons in living tissue are sufficiently stabilized in this way, but not all.

Atoms and molecules can lose this stability and become unbalanced molecular fragments or free radicals. Gropping around in search of a partner, they compulsively steal electrons from surrounding molecules, including those that make up living cells. Cells can suffer damage to their outer membranes or inner organelles and become effectively disabled. When enough cells are damaged, individual organs suffer and we get sick. Free radical attack has been blamed in whole or in part for a growing number of diseases. Some scientists actually attribute all disease, not to mentioning aging itself, to the accumulated damage of free radicals.

Free radicals are not just caused by outside threats. They’re also created in the body as a routine by-product of the body’s normal functions, especially cellular respiration—the way cells use oxygen to stay alive. Each cell contains tiny power plants that produce energy by breaking up atoms and passing their electrons like hot potatoes from one protein molecule to another. The process is profoundly complex, utterly awe-inspiring and barely understood. At the end of each energy cycle most atoms are restored to their original state, but it’s been estimated that up to 2 percent of the oxygen used in cellular respiration may end up as superoxide radical. Given that the human body contains about one hundred trillion cells, and each cell routinely produces a billion reactions in a few minutes of energy production, this single process releases trillions of free radicals each day. And this is just from cellular respiration. We can add to that the damage caused by pollutants and other harmful substances. Cigarette smoke produces one trillion free radicals per puff. Then there’s polluted air, the damaging fried fats in fast food, ultraviolet radiation—the list is endless. We can dodge some of them but not all.

Risk factors
It is safe to say that most of us would never consider consuming potentially contaminated or spoiled food. However, on a daily basis we’re eating food in which oxidation is working in full force to convert fatty acids to hydroperoxides and peroxides (toxic and dangerous deravatives) but still looks and tastes fine and is well within shelf life guarantees. Intake of these toxic oxidation compounds constitutes a compounding danger to our health by stressing and exhausting the body’s already taxed defense system. This oxidation is even more dangerous than consuming food contaminated by bacteria, which will be immediately rejected by our systems.

Other sources of free radicals are alcohol, asbestos, calorie-dense fatty foods (hamburgers, French fries, chocolates, cakes, etc.), chlorinated water, all sorts of smoke, ionizing radiation (including overexposure to sunlight), pesticides, silica dust, various solvents and disinfectants, many pharmaceutical and recreational drugs and certain trace metals. Plus of course, stress. Given today’s reality, very few of these are truly avoidable, which is why we have to reinforce the body’s antioxidant defenses.

Antioxidants
Antioxidant molecules are able to donate or receive spare electrons without losing balance themselves and without passing on the imbalance. They’re sometimes called shock absorbers. Their ability to do this lies in special molecular structures, in which they can shift their own electrons around into various configurations to absorb or donate electrons without bothering other molecules.

However, too many antioxidants can actually interfere with our immune response—a sophisticated defense system comparable to a modern army. It has specialized reconnaissance, intelligence and attack units and a variety of troops and weapons for different targets. The lowly phagocyte is the foot soldier. It’s a large, rather lumbering cell whose job is to mop up the innumerable microbes that make their way into our bodies. Its weapon is the hydrogen peroxide radical, which it spits into the path of incoming invaders. If the battlefield—the space between the cells—is too rich in antioxidants, the radicals are neutralized before they have a chance to do their work, enabling the invaders to dig in and make us sick. Such imbalance in the body between free radicals and antioxidants may result from eating a poorly balanced combination of dietary antioxidants that leaves some improperly absorbed and accumulating in the wrong places. Oil soluble antioxidants such as beta
carotene are particularly guilty. In fact, beta carotene seems to make matters worse for smokers suffering from lung cancer, even though other cancer researchers are trying to get free radicals to destroy cancer cells. For this and other reasons, we know there are limits to the advantages of antioxidants.

In spite of these complications, however, there is plenty of statistical evidence to suggest that a balanced and varied consumption of dietary antioxidants reduces the overall risk of degenerative disease.

Endogenous/exogenous antioxidants, and antioxidant-antioxidant balance
The body has its own ways of dealing with the free radicals produced by routine bodily processes—it manufactures its own antioxidants. You may have heard of superoxide dismutase (SOD), glutathione (GSH), squalene and coenzyme Q10. We get other antioxidants from the famous five daily servings of fresh fruits and vegetables that we’re all supposed to eat.

The antioxidants made by the body are immensely important. Like dietary antioxidants they possess electron-abstracting properties, but they do more. Glutathione—the master antioxidant—recycles vitamins C and E as well as lipoic acid, multiplying their effectiveness many times over. Unlike dietary antioxidants, the body’s own antioxidants are manufactured on demand, putting the right quantity in the right place at the right time.

However, the risk factors of modern life are rapidly consuming antioxidants and stretching the body’s inner mechanisms to their limit. We need additional supplies of good quality dietary antioxidants.

Preventive medicine
To protect ourselves we invest in lifestyle changes, exercise, a healthy diet and supplementation. Antioxidants are only one element in the big picture, so products with multiple uses are particularly useful. After all, there’s a limit to the number of supplements we can swallow in a day, let alone afford, so we need to supplement wisely. For example, consuming un-denatured whey protein raises intracellular glutathione levels and takes advantage of its three protective functions: T-cell synthesis, antioxidation and detoxification. Spirulina is an effective dietary antioxidant with dozens of well-known health benefits. Rosmarinic acid is another product that offers multiple advantages.

Rosmarinic acid
Rosemary and its cousins, oregano and thyme, have been known for their medicinal properties for centuries and rosemary oil has long been used in cooking, aromatherapy and in hair and skin tonics. It has been described traditionally as good for the skin, scalp, digestion and treatment of colds and is used as an antiseptic, stimulant and antispasmodic. Today, medical scientists are particularly interested in rosmarinic acid for its anti-inflammatory, antiallergic and antioxidant properties.

Rosmarinic acid’s multiple value also lies in its boxer’s one-two approach: first, as a purely natural food additive it prevents or neutralizes the harmful oxidation that takes place while food is on the shelf, enhancing its quality and helping to prevent an additional tax on the body’s over-burdened defense system. Then, once the food is eaten, the same additive turns out to be a powerful dietary antioxidant. Of course, it can be used as a direct supplement. An added bonus of its that rosmarinic acid does not interfere with intracellular antioxidant balance and enables the immune system’s phagocytes to use their free-radical weapons effectively against incoming disease organisms.

RA’s antioxidant power
The most common free radicals attacking living tissue are reactive oxygen species (ROS)—or oxyradicals. They include the peroxyl, nitric oxide and superoxide-anion radicals plus singlet oxygen, peroxynitrite and hydrogen peroxide. Worse of all is the dangerous hydroxyl radical, formed by the combination of the weaker superoxide radical with hydrogen peroxide. Rosmarinic acid neutralizes the superoxide-anion and thus makes a major contribution to curbing oxidative damage in the body.

Rosmarinic acid also takes the heat of the more well-known antioxidants by getting into the fray and dealing with free radicals first, leaving vitamins C, E and others intact for later use. This extract is also one of the few antioxidants able to cross the blood-brain barrier and combat the superoxide radical in the brain, where researchers hope it may help prevent or combat such degenerative conditions as Alzheimer’s disease.

The manufacturer
Researchers at the Israeli biotechnology company RAD Natural Technologies discovered that certain natural species of the plant Origanum vulgare contained particularly high concentrations of rosmarinic acid. Without genetic modification the plant yields a highly purified extract that is effective in very low concentrations. With neither solvents nor processing chemicals, RAD Natural Technologies is able to preserve the integrity of the plant extract and produce a water-soluble powder that can alternatively be emulsified and thus dissolved in fats and oils. It’s ideal for industrial applications. If you’ve always thought of antioxidants as pills and dietary supplements, think again.

The company’s rosmarinic acid product is called Origanox, and it is sold for food processing, cosmetic and dietary purposes. Its antioxidant properties preserve natural pigments, odors and flavors and also protect vitamins and other active ingredients from the degenerative effects of oxidation. It also possesses antibacterial, antifungal, antiviral and anti-inflammatory properties and is easily absorbed into the skin where it potentially supports the neutralization of the harmful effect of ultraviolet radiation.

Rosmarinic acid maintains its electron-absorbing properties at sustained high temperatures. That means that when it is added to edible oils, the number of free radicals released by frying is diminished. It is stable for long periods and at temperatures as high as 180°C/356°F so it can be baked into foods without impairing its antioxidant properties.

Besides its standard-grade rosmarinic acid, the company manufactures an enriched version, using a patented purification technology for special applications in food, health food, cosmetics and the manufacture of an oil-based version (to be available in a short while for the protection against rancidity of oils and oil-containing (baked and fried) products.

Conclusion
Free radicals come at us from every conceivable direction and we need a good variety of antioxidants to protect ourselves. Some, like glutathione, are produced by the body, and are dependent upon a supply of raw materials from dietary sources. Others, like vitamins C and E, are built into the foods we eat or supplement in our diets. We may not be used to thinking of food preservatives as health aids but rosmarinic acid is a valuable aid that supports to preempt free radicals before they form in stored food and prevents the most harmful effects resulting from cooking with all sorts of oils. It also functions as a powerful antioxidant with the rare ability to cross the blood-brain barrier.

The essential oil of Origanum vulgare is a powerful, anti-microbial agent and natural, anti-septic product. It has many, very promising applications in certain feed and food products besides being a flavor enhancer and therapeutic component in health food supplements. This potent and adaptable product promises to become a valuable addition to our preventive medicine arsenal.