Focus On: Antioxidants and Phytonutrients.

What are Free Radicals?

Free radicals are highly reactive molecules with an unequal balance of charges, usually produced during normal cellular metabolism. Free radicals have unpaired electrons, making them unstable and reactive. Formation is a sort of chain reaction, or domino effect, one free radical steals an electron from a molecule so that it can be paired and stabilized, in the process creating another free radical from the molecule it just stole an electron from. This is a normal function, like a by product of cellular metabolize. An over production of free radicals, however, can cause oxidative stress and cellular damage. Weakening membranes, damaging proteins, and in effect damaging DNA, mutating genes, accelerating signs of aging, and possibly contributing to some cancers, among other things. Exposer to toxins, cigarette smoke, drugs, intense light, aging, stress, and illness or injury are all things that contribute to elevated production of free radicals in the body.

What are Antioxidants?

Antioxidants are compounds found in foods that can combat the negative effects of free radicals by essentially gifting it an electron so that it can be paired once more. For example, Vitamin C, an antioxidant, can lend hydroxyl (OH^-), which is a free radical, a hydrogen atom and its electron. This ends up reducing hydroxyl (OH^-) to water (H_2O). Antioxidants provide critical protection from the damaging consequences of free radicals. Interestingly there is some thought that we age because of free radical damage, rather than produce more free radicals because we age. It stands to reason why antioxidants are recommended for age related symptoms such as wrinkling of the skin (weakening of membranes).

What are Phytochemicals?

When scientists learned that there was a connection to diet and health, they discovered that foods also contained other substances that influenced health aside from macronutrients that provide energy (carbohydrates, proteins, and fats), and micronutrients that provided the necessary ingredients for cellular function (vitamins and minerals). When health-promoting compounds such as these are found in plants, they are called phytochemicals, aka phytonutrients. Plants produce these chemicals to protect themselves, but research has demonstrated that they can also protect humans against diseases. There are more 20,000 known phytochemicals. Some of

the well-known phytochemicals are lycopene in tomatoes, isoflavones in soy and flavonoids in fruits.

Most phytonutrients are antioxidants, although others may have anti bacterial properties such as allicin found in garlic, while others can bind physically to cell walls thereby preventing the adhesion of pathogens to human cell walls, such as proanthocyanidins found in cranberries that help in prevention of bladder infections. Some typical phytonutrients are carotenoids, ellagic acid, flavonoids, resveratrol, glucosinolates, and phytoestrogens. Carotenoids are powerful antioxidants, and some examples are lycopene found in tomatoes, and beta-carotene found in yellow and orange vegetables. Flavonoids such as catechins are also a antioxidant and found in places like green tea and dark chocolate. Research is continuous in this field and it is worth noting that studies done with antioxidants as supplements and their antiaging and chronic disease preventing properties are not conclusive. Having said that, there is an abundance of research that point towards the beneficial elements of antioxidants/phytonutrients that are still within their natural "housing". In other words, whole fruits, vegetables, and grains rich in their naturally occurring antioxidants and all their other molecules that help them.

Antioxidant Rich Foods *(this is not an extensive list)*

Vitamin C: *Broccoli, Brussels sprouts, cantaloupe, cauliflower, grapefruit, leafy greens (turnip, mustard, beet, collards), honeydew, kale, kiwi, lemon, orange, papaya, snow peas, strawberries, sweet potato, tomatoes, and bell peppers (all colors)*

Vitamin E: *Almonds, avocado, Swiss chard, leafy greens (beet, mustard, turnip), peanuts, red peppers, spinach (boiled), and sunflower seeds*

Carotenoids including beta-carotene and lycopene: *Apricots, asparagus, beets, broccoli, cantaloupe, carrots, bell peppers, kale, mangos, turnip and collard greens, oranges, peaches, pink grapefruit, pumpkin, winter squash, spinach, sweet potato, tangerines, tomatoes, and watermelon.*

Phenolic compounds: *Quercetin (apples, red wine, onions), catechins (tea, cocoa, berries), resveratrol (red and white wine, grapes, peanuts, berries), coumaric acid (spices, berries), anthocyanins (blueberries, strawberries)*