

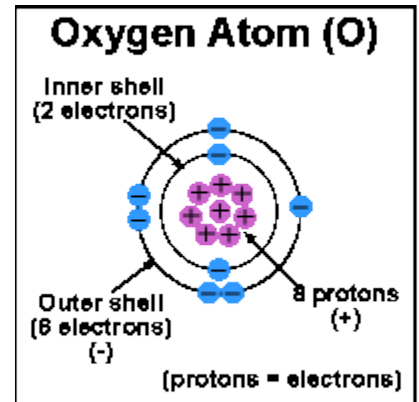
Understanding Free Radicals

What are free radicals? Why are they damaging to the human body? And how does vitamin E and the other antioxidant nutrients help protect the body against free radical damage? We'll attempt to answer these questions and help you understand why eating 5-8 servings per day of anti-oxidant rich fruits and vegetables can benefit your health. But first, a little background?

Background: A Brief Look at Chemical Bonding

To understand the way that free radicals and antioxidants interact, you must first understand a bit about cells and molecules. So here's a (very) brief refresher course in Physiology/Chemistry 101: The human body is composed of many different types of cells. Cells are composed of many different types of molecules. Molecules consist of one or more atoms of one or more elements joined by chemical bonds.

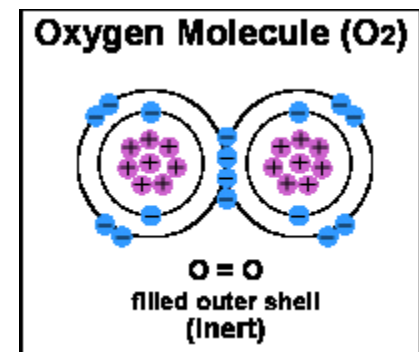
As you probably remember from your old high school days, atoms consist of a nucleus, neutrons, protons and electrons. The number of protons (positively charged particles) in the atom's nucleus determines the number of electrons (negatively charged particles) surrounding the atom. Electrons are involved in chemical reactions and are the substance that bonds atoms together to form molecules. Electrons surround, or "orbit" an atom in one or more shells. The innermost shell is full when it has two electrons. When the first shell is full, electrons begin to fill the second shell. When the second shell has eight electrons, it is full, and so on.



The most important structural feature of an atom for determining its chemical behavior is the number of electrons in its outer shell. A substance that has a full outer shell tends not to enter in chemical reactions (an inert substance). Because atoms seek to reach a state of maximum stability, an atom will try to fill its outer shell by:

- Gaining or losing electrons to either fill or empty its outer shell
- Sharing its electrons by bonding together with other atoms in order to complete its outer shell

Atoms often complete their outer shells by sharing electrons with other atoms. By sharing electrons, the atoms are bound together and satisfy the conditions of maximum stability for the molecule.



How Free Radicals are Formed

Normally, bonds don't split in a way that leaves a molecule with an odd, unpaired electron. But when weak bonds split, free radicals are formed. Free radicals are very unstable and react quickly with other compounds, trying to capture the needed electron to gain stability. Generally, free radicals attack the nearest stable molecule, "stealing" its electron. When the "attacked" molecule loses its electron, it becomes a free radical itself, beginning a chain reaction. Once the process is started, it can cascade, finally resulting in the disruption of a living cell.

Some free radicals arise normally during metabolism. Sometimes the body's immune system's cells purposefully create them to neutralize viruses and bacteria. However, environmental factors such as pollution, radiation, cigarette smoke and herbicides can also spawn free radicals.

Normally, the body can handle free radicals, but if antioxidants are unavailable, or if the free-radical production becomes excessive, damage can occur. Of particular importance is that free radical damage accumulates with age.

How Antioxidants May Prevent Against Free Radical Damage

The vitamins C and E, are thought to protect the body against the destructive effects of free radicals. Antioxidants neutralize free radicals by donating one of their own electrons, ending the electron-"stealing" reaction. The antioxidant nutrients themselves don't become free radicals by donating an electron because they are stable in either form. They act as scavengers, helping to prevent cell and tissue damage that could lead to cellular damage and disease.

Vitamin E ? The most abundant fat-soluble antioxidant in the body. One of the most efficient chain-breaking antioxidants available. Primary defender against oxidation. Primary defender against lipid peroxidation (creation of unstable molecules containing more oxygen than is usual).

Vitamin C ? The most abundant water-soluble antioxidant in the body. Acts primarily in cellular fluid. Of particular note in combating free-radical formation caused by pollution and cigarette smoke. Also helps return vitamin E to its active form.

The Antioxidants and Disease Prevention

- Heart Disease ? Vitamin E may protect against cardiovascular disease by defending against LDL oxidation and artery-clogging plaque formation.
- Cancer ? Many studies have correlated high vitamin C intakes with low rates of cancer, particularly cancers of the mouth, larynx and esophagus.

The Lesson: Eat Your Fruits and Vegetables!

The antioxidants are believed to help protect the body from free-radical damage. But before you go out and stock your pantry with mega-doses of these vitamins, be warned: more is not always better. The long-term effect of large doses of these nutrients has not been proven. Other chemicals and substances found in natural sources of antioxidants may also be responsible for the beneficial effects. So for now, the best way to ensure adequate intake of the antioxidant nutrients is through a balanced diet consisting of 5-8 servings of fruits and vegetables per day.