Free Radical Theory of Aging

The free radical theory of aging was first proposed in 1954 by Denham Harman. “Aging: a theory based on free radical and radiation chemistry” was published in 1956 in the Journal of Gerontology. A free radical is an atom that has an unpaired electron in its outer most valence shell. This atom will attempt to fill its valence configuration by taking an electron from another atom. This will usually cause this atom to become a free radical as well, starting a chain reaction. This reaction can be stopped by the presence of an antioxidant, which is stable even when one of its electrons is taken. Vitamins C and E are two of the most common antioxidants found in the body. A free radical causes damage to the body when it encounters a molecule in a cell and converts it into a free radical. Cell membranes, in particular, are made of unsaturated lipids. When exposed to free radicals, the cell membrane can harden (this is known as lipid peroxidation). This prevents the cell from receiving nutrients, among other things, leading to the death of the cell. One of the primary ways that free radicals are thought to cause aging is by damaging the mitochondrial DNA. Unlike nuclear DNA, mitochondrial DNA has a limited ability to repair itself, and so it accumulates damage, eventually shutting down. This theory is supported by a large body of evidence. Lab tests have found that the life span of various organisms can be extended or shortened by altering the organisms’ susceptibility to free radical damage. Other tests have shown that caloric restriction can reduce the amount of free radicals present in the body and extend lifespan. It is generally accepted that free radicals are at least a contributor to the aging process, however, their role is still a topic of controversy in the scientific and medical communities.

Sources:

Harman, D (2006).Free Radical Theory of Aging: An Update. *Annals of the New York*

*Academy of Sciences*. *1067*, 10-21.