

## Phytonutrients, Lifelong Wellness, and the Theories of Aging

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An ever-expanding cornucopia of research demonstrates that a diet high in fruits and vegetables significantly reduces the risk of many, if not all, of the so-called "common diseases of aging".<sup>1</sup> Although expert lists may differ, the more serious common diseases of aging certainly include dementia; ARMD and cataract; stroke, heart disease, and atherosclerosis; emphysema, pneumonia and COPD; cancer; diabetes; and osteoporosis and osteoarthritis.

### Common Theories of Aging

The theories as to why we age are numerous and constantly evolving. Here are a few:<sup>2</sup>

#### 1. Catastrophic Accumulated Damage Theories

- The Free Radical Theory: Accumulated damage caused by oxygen radicals slowly "burns" cells, eventually causing cells, tissues, organs and related systems to stop functioning.
- Accumulation of DNA Damage: Damage to DNA mechanisms that synthesize proteins results in faulty proteins, which accumulate to a level that causes "catastrophic" damage to cells, tissues and organs. The high oxidant exposure of mitochondrial DNA, and its poor ability to repair itself as compared to nuclear DNA, are thought to make it most susceptible to such accumulated damage. Mitochondrial damage would also lead to a loss of energy.
- Somatic Mutation: Genetic mutations accumulate with age, causing cells to deteriorate and malfunction. Oxidizing radiations are a major cause of such mutations.
- Rate of Living: The greater the rate of oxygen basal metabolism, and therefore the greater the internal oxidative stress, the shorter the life span.
- Cross-Linking Theory: An accumulation of insoluble and "cross-linked" proteins damages cells and tissues. Skin wrinkling, secondary to oxidizing radiation from the sun's UV rays, is an example. Advanced glycated end-products (AGEs) are related to micro-circulation cross-linking errors. AGEs are an offshoot of a reaction occurring between a sugar and a free amino acid. In diabetes, accelerated cross-linking in capillaries leads to retinopathy, nephropathy and neuropathy.

It should be noted that the main reason postulated for DNA damage, somatic mutation, and rate of living theories is related to oxidation and the free radical theory.

#### 2. The "Inflamm-aging" Theory

- Inflammatory Theory: A global reduction in the capacity to cope with immune

stressors, a weakening of related enzymes systems, and a concomitant progressive increase in pro-inflammatory status, are major characteristics of the aging process. This phenomenon is thought to be provoked by decades of continuous antigenic load and stress.

### 3. Pre-Programmed Theories

These are "built-in" breakdown theories. Aging is a direct consequence of genetic programming. The causes for aging are directly built into the genome and cellular structure, as a sort of molecular clock.

- Programmed Senescence. Experiments have shown that human cells will divide less than 100 times outside of the body. Also, there is an inverse correlation between the number of cell divisions and the age of the person from which the cells were taken. Aging is therefore predetermined in the genome. The related Telomere theory suggests that cell death is caused by the shortening of telomeres, which are "caps" on the ends of chromosomes. When the telomeres get too short, the cell stops replicating and dies off (apoptosis), which eventually leads to the demise of the entire organism.
- Endocrine Theory. Biological clocks act through hormones to control the pace of aging. Aging is associated with somatopause, andropause and menopause and the lowering of the so-called "hormones of youth," including the sex hormones.
- Immunological Theory. A programmed decline in immune system functions, and involution of the thymus, lead to an increased vulnerability to infectious disease and thus aging and death.

#### Phytonutrients and the Common Theories of Aging

"Diets rich in phytochemicals provide protection from vascular diseases and many cancers [through] direct antioxidant activity as well as modulation of enzyme expression or hormone activity ... the total dietary load of phytochemicals may have important implications for health."<sup>3</sup>

Phytonutrients are a class of chemicals found in plants, i.e., phytochemicals. Despite the name, phytonutrients generally are not nutrients as such, but nonetheless have the potential to favorably modulate human metabolism in multiple ways.

Phytochemicals can be grouped into families based on their chemical structure and biological activity.<sup>4</sup> As such, phytonutrients can be classified as terpenes, phenols, polysaccharides, organic acids, organosulfurs, amines, and certain lipid eicosinoids. These can be further subclassified. For example, the terpenes include the carotenoids, chromanols, saponins, and limonoids; the phenols include the flavonoids, OPCs, catechins, and so on. Understandably, the U.S. government has tried to keep it simple by recommending we all just eat lots of fruits and vegetables of various colors!

Today, numerous researchers worldwide are endeavoring to investigate and confirm possible functional properties in foods, phytonutrient or otherwise, beyond the more familiar vitamins and minerals, that could be efficient in preventing the common diseases of aging such as macular degeneration, heart disease, atherosclerosis, diabetes, dementia, and cancer.

A small example of this research on phytonutrients suggests individual phytonutrients can:<sup>5-17</sup>

- serve as powerful, tissue-specific, water- and fat-soluble antioxidants (organic acids,

- flavonoids, proanthocyanins, catechins, carotenoids, tocopherols);
- help repair DNA damage (the polyphenols resveratrol, quercetin, rutin, catechin; chlorella amines and CGF);
- inhibit mutation (carotenoids, especially lycopene);
- lower glycemic load (polysaccharide soluble fibers);
- enhance insulin sensitivity (organic acids from cinnamon);
- modulate inflammatory functions (omega-3 fatty acid eicosanoids, quercetin and catechins, amine plant enzymes);
- promote life extension (resveratrol);
- modify cellular receptor uptake of hormones, (phytoestrogen phenol isoflavones);
- detoxify carcinogens through the activation of the cytochrome P450 and phase II liver enzyme systems, (the organo sulfurs sulforaphane and indole-3-carbinol);
- cause cell death, also known as apoptosis, in cancer cells, (carotenoids, catechins, organo sulfurs);
- enhance resistance and immune responses, (cranberry and raspberry organic acids, pre-vitamin A carotenoids); and
- modulates angiotensin I converting enzyme to help lower blood pressure, (proanthocyanins, catechins).

### Conclusion: Functional Foods and Phytonutrients Against Chronic Diseases

Most authorities agree that the best nutritional foundation for lifelong wellness is from natural whole foods. They also agree that efforts to improve the quality of the Western diet have been mixed at best. In order to increase the nutrient density in the industrialized societies, "functional food" products are increasingly promoted. Inclusion of phytonutrients in such functional foods is a common strategy.

The ever-clearer take-home message for those wishing to delay the onset of the "all too common" diseases of aging and promote lifelong wellness is that both our dietary and supplementation habits would do well to include a wide variety of whole-plant foods and whole-food supplements, nutrient dense in a balanced, broad, full-color spectrum of phytonutrients.

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