

# The Aging Process

**A**ging is a process that affects everyone but is frequently misunderstood. Many young people believe that getting “old” is a problem just for the chronologically aged. If they think about aging at all, they view it as a problem that develops in the distant future. Others think they are predetermined to age and die at point determined by their genetics. Neither perspective is correct. While it is true genetics play some role, the rate at which you age is under your control from a very early age.

One thought you should take out of this paper is that **aging is a cumulative, compounding and largely hidden process** until later in life. Some even compare it to a chronic wasting disease. It is almost always the facilitator to most of the illnesses that strike later in life. Proper diet and exercise slow the aging process, but other lifestyle factors can be just as important.



Some aspects of the aging process begin as early as the womb and remain hidden until a much older age. Aging processes begin to accelerate just past the maturation stage when we are in our early teens. At this point our bodies are so ramped up in support of reproductive health that the subtle cellular

level degradations are not noticed. However, the damage is occurring and accumulating. As these processes, see appendix at end, unfold, they also begin to compound each other. For example, mitochondrial DNA damage accelerates cell loss and atrophy throughout the body.

So that Hollywood moment when the actress looks in the mirror and suddenly realizes she is old, is not really a precise moment at all. We all start aging from day one and modern society gives us plenty of ways to accelerate the process. If you want to **SLOW** the aging process, you'll need at least a basic understanding of the mechanisms of aging. Specific age management strategies are a subject of another paper and built into any fitness programs at your request, but first let's understand the problem.

## Mechanisms of Aging

Depending upon the researcher's breadth of inclusion, I have seen basic aging mechanisms grouped in seven to fourteen categories. I like De Grey's seven categories as covered in the **appendix at the end of this paper**. In **GENERAL**, if we avoid disease, accidents, poor diet and destructive lifestyle habits, these mechanisms of aging can remain largely manageable until our 70s and 80s. However, even among the impending centenarians, on average in their early 90s their physical decline becomes palpable. By the way the number of persons reaching centenarian status in the USA is about 20 per 100,000 versus 50 in Okinawa, Japan.

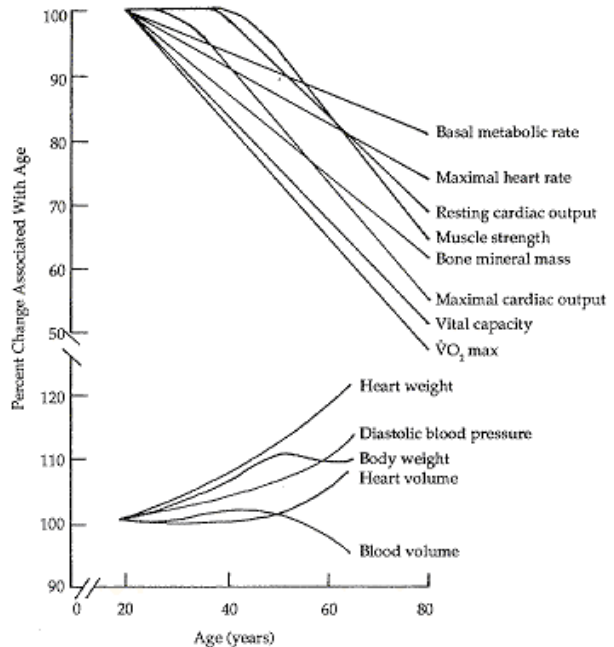
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The physiological and measurable signs of aging are numerous and more apparent as we age. Among sedentary adults, by the age of 65-70 changes include:

- > The heart pumps 20-30% less blood
- > Cardiovascular capacity, VO<sub>2</sub> max, declines 40-60 % (more for women)
- > Muscle mass declines 40% (sarcopenia)
- > Bone mass in women can decline by 30-40% (less for men)
- > Blood pressure increases by 10 – 40 mm Hg from decreased elasticity

Add to the above a weakened immune system, digestive system decline, lethargy, thinning hair and skin, loss of libido, declining mental alertness, general frailty, sleeplessness, wrinkles, to name a few problems. Often the under 65 crowd has already earned a “disease of civilization” such as diabetes, osteoporosis, dangerously high blood pressure, premature heart disease or cancer. However, for the successful aging crowd, many of these problems are minimized and delayed until much later in life.

Note in the previous paragraph that the observed physiological rates of change were for **SEDENTARY** adults. Exercise is not a cure-all for aging but it can slow the progression of many detrimental changes, how much is still under study. Suffice to say we know what accelerates aging, so anti-aging strategies begin with taking the foot off the accelerator.



## Beware the Magic Bullet

Once you understand the multiple factors in the aging process, you are less likely to fall prey to the hucksters who promise a quick fix. There is no single pill or intervention that is going to address all seven basic mechanisms of aging. Supplement manufacturers and the pharmaceutical companies both spew a ton of misinformation when it comes to your health. My pet peeve is the cholesterol scam, the simplistic claim that low cholesterol is the key to cardiovascular health. Not true, high cholesterol is just one of over 17 cardiovascular risk factors. However, high cholesterol is the only risk factor that is treatable by expensive patent medicines. Follow the money!

Also stay aware that your physician, as part of the Traditional Medical Establishment (TME) is geared toward the treatment of disease, not the maintenance of health. Someday we may say, “Hey Doc, my heart muscle fibers are undergoing glycosylation and cross linking, can you help?” But for now, the TME physician figuratively plays whack a mole. Their focus is after the fact treatment of acute illnesses and end symptoms (like atherosclerotic plaques) that pop up with ever increasing frequency. Prevention is not covered. As a result, the TME helps us live longer but often in a truly depressing state of increasing morbidity. Of course, if you are ill the TME has developed powerful treatments that should be utilized, just do everything you can to minimize and delay the need.

So understand it is up to you to undertake the diet and lifestyle changes that slow the progression of aging and illness. There are proven diet, exercise and lifestyle changes that broadly delay the aging process. **See the Anti-Aging links on the Library and Natural Solutions pages at the website.** My goal is not to achieve absolute longevity, but longevity coupled with high functionality, a.k.a. successful aging in the medical literature.

## References/Further Reading

De Grey, Aubrey. Ending Aging. New York: St Martin’s Press, 2007

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Espel, Elissa, et al. “Accelerated telomere shortening in response to life stress.” Proceedings of the National Academy of Sciences 101.49 (2004): 17312-15

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## WHY DO WE HAVE TO AGE?

Maybe the bigger, non-spiritual, question has crossed your mind, why was the human body designed only to last 80 or more years. Two similar and complementary theories make sense to me.

1. Antagonistic Pleiotropy – the same genes and expression that are useful for reproduction become harmful post reproduction. Example, a gene that prevents cancer in youth reduces tissue replacement in the aged.

2 – Disposable Soma – the body (soma) directs resources between reproduction and repair depending upon the length of fertility. The longer the reproduction period, the longer repair processes will maintain viability. Like salmon, post reproduction, the body has no value.

How to condense this subject into just a few pages proved to be particularly difficult. This and related papers were written to provide just an overview and a starting point for anyone who wants to learn more about this subject. I briefly list some of the more common outcomes of these aging mechanisms. I ask the more scientifically orientated to be forgiving of the generalizations and omissions that this approach requires.

The first seven categories are from De Grey (2007), followed by largely overlapping categories and terms that are commonly used by other researchers.

**1. Cell Loss and Atrophy** – some cells such as those in the heart or neurons have little or no reproductive capacity. As they wear out they are not replaced. Other cells lose their reproductive capacity over time. This is most often due to telomere shortening, the DNA end caps that protect the reproducing chromosome. Each replication shortens the telomere, although the telomerase enzyme can add it back – to a limit. This is known as the Hayflick Limit and is believed to number about 50 for most cells. Telomere shortening is often a category by itself and can be profoundly accelerated by lifestyle factors such as stress.

**2. Extra cellular Abnormal Protein Aggregates**– these are miss-folded proteins, beta-amyloids, that accumulate outside cell structures. This aberrant structure causes a stickiness so they daisy chain together and build up like a choking weed around cells. In the brain, these form plaques and oligomers that contribute to Alzheimer's.

**3. Random Extra cellular Protein Cross Links** – structural proteins in muscles, organs, eyes and blood vessels are slowly “cooked” by the incomplete byproducts of glucose metabolism. Excess glucose molecules latch onto cell surface proteins (glycosylation) and damage their functioning. These sticky conglomerates, Advanced Glycogen End-products (AGEs), also cross link proteins together and decrease tissue elasticity. Heart failure, hardened arteries, collagen stiffening and cataracts are just some of the results. In diabetics, high circulating glucose levels turn the AGE generating process on high. In addition, AGEs and other reactive substances form and are ingested from food cooked at high temperatures – grilling, charbroiling, frying, etc.

**4. Death resistant cells (Immune System Dysfunction)** – some cells should die because they are non-functioning and need replacement. Some even become harmful, such as cancer, covered separately. In our immune system, T cells are a critical defense against infection. Over time, in a misdirected adaptation to chronic infection, the immune system builds up an army of anergenic (weak) T cells. These cells do not die to make way for new T cells nor do they adapt to new assaults. An infection that causes a sniffle in a young person ends up overtaking the elderly.

**5. Mitochondrial DNA damage** – most cells contain hundreds to thousands of mitochondria, small structures (organelles) that function like miniature power plants. These structures have their own DNA outside of the cell's nucleus. Mitochondria are where glucose and fatty acids are converted into the energy molecule, ATP. This activity creates free radicals, a.k.a. Radical Oxygen Species (ROS)s, as metabolic byproducts. ROSs damage mitochondrial DNA first by their near proximity and then other cell structures before they are neutralized by anti-oxidant processes. It appears older, DNA damaged mitochondria can export this damage throughout the body and may contribute to an overall inflammatory affect.

**6. Intracellular Lysosomal Aggregates** – cells have internal organelles, liposomes that are supposed to break down and remove broken cellular components. Over time and if not completely removed lipofuscin, a garbage like substance, accumulates. This leads to toxic buildups that contribute to macular degeneration and may play a part in Alzheimer's and Parkinson's disease. Age spots are the accumulation of lipofuscin in skin cells. Another type of liposome dysfunction occurs when white blood cells (macrophages) attempt of to clean up damaged, inflamed arteries. When their liposomes fail their digestive tasks, macrophages morph into unstable, fatty streaks known as foam cells. These form dangerous plaques in arteries that restrict blood supply and or rupture and cause other blockages, often leading to a stroke.

**7. Nuclear DNA Damage** – the DNA in all cells is constantly degraded by telomere shortening, byproducts of metabolism, radiation and chemicals. Damage affects the

epigenetic structures attached to DNA that control what genes are turned on or off. At a certain point the cell can die or in a desperate survival attempt, become cancerous. The most deadly cancer cells rapidly mutate and multiply, so that 99% eradication is not enough. The remaining 1% will come back resistant to the previous treatment.

### OTHER POPULAR CATAGORIZATIONS

**Endocrine System Decline** – often listed separately, but more of an outcome of the basic mechanisms affecting the constituent cells than a root cause. Decline in the endocrine system results in less testosterone, estrogen, DHEA, Growth Hormone (GH) and insulin like growth factor-1 (IGF-1). The decline in the sex related hormones is usually most obvious with the decline in sexual fertility and desire. However, all these hormones also are critical to routine tissue remodeling and rebuilding processes.

**Glycosylation** – the process that leads to #3 above.

**Immune System Decline** – the result of many of the basic mechanisms above, notably, death resistant cells. Other damage to the DNA reduces the ability of the immune system to differentiate and conquer invaders while not harming the body.

**Telomere Shortening** – one of the primary causes of cell loss and atrophy, #1 above.