

Anti-Aging Medicine: Hype, Hope and Reality



Before discussing whether intervention in the aging process is possible the four aspects of the finitude of life must be defined.

- 1. Aging**
- 2. Longevity Determination**
- 3. Age-associated diseases**
- 4. Death**

What Is Biological Aging?



Biological aging is caused by the loss of molecular fidelity that occurs stochastically and systemically after reproductive success eventually exceeding the capacity for repair.

This progressive loss of molecular fidelity increases vulnerability to age-associated diseases.

Why Does Aging Occur?



Through natural selection, complex biological molecules have evolved electrical energy states sufficient to maintain fidelity only until the animal that they constitute reaches reproductive success.

Why Does Aging Occur?



The loss of molecular fidelity that characterizes the aging process results from decrements in energetics (electrical properties) of molecules that are vital in maintaining their structural and functional integrity.

The Second Law of Thermodynamics Applies



In closed inanimate systems, entropy or molecular disorder, increases. In time everything changes or ages.

Because biological systems are open the process is similar but not identical.

Properties of Biological Molecules that are Thermodynamically Unstable



EXAMPLES:

Hydrogen bonds

Covalent bonds

Van der Waals forces

Damage Caused by Molecular Instability:



Examples:

Covalent modifications like glycation

Conformational alterations leading to inactivity

Aggregation and precipitation of proteins

Amyloid formation

Protein degradation and synthesis rate alterations

DNA alterations

Mitochondrial alterations

The Differences Between Aging and the Determinants of Longevity



First of three premises:

Natural selection demands that the energy necessary to maintain molecular fidelity must be retained from conception to reproductive success and, if necessary, until raising progeny to independence. If not, the species will vanish.

The Differences Between Aging and the Determinants of Longevity



Second premise:

The best strategy for guaranteeing survival to reproductive success is to select for redundant physiological capacity in vital organs and better survival skills.

The Differences Between Aging and the Determinants of Longevity



Third premise:

The excess physiological capacity gained after reaching the age of reproductive success is what indirectly determines longevity.

The Differences Between Aging and the Determinants of Longevity

Four Conclusions:

1. Redundant physiological capacity at the time of sexual maturation governs additional survival time.
2. The genome directly determines events from conception to sexual maturation. Post-reproductive longevity is determined indirectly.

The Differences Between Aging and the Determinants of Longevity



3. Longevity is determined by how well the fidelity of molecules can be maintained and how efficient repair capacity is from the time of reproductive maturity.
4. The molecules present from the time of reproductive maturity and those replaced by turnover processes form the substrate upon which the aging process acts.

Why Aging Is Not a Disease



Six Reasons

Unlike Any Disease:



1. Age changes occur in every animal that reaches a fixed size in adulthood.
2. Age changes cross virtually all species barriers.
3. Age changes occur only after the age of reproductive success.

Unlike Any Disease:



4. Age changes occur in feral animals protected by humans even after that species may not have experienced aging for thousands or millions of years.
5. Age changes increase the vulnerability to death in all animals in which it occurs.
6. Age changes occur in both animate and inanimate objects.

What If All Causes Written on Death Certificates Were to Be Resolved?



In developed countries there could only be an increase in life expectancy of about 15 years.

Increase in Life Expectancy if the Leading Causes of Death are Resolved

<i>CAUSE OF DEATH</i>	<i>APPROXIMATE INCREASE IN YEARS</i>	
	<i>(At birth)</i>	<i>(At age 65)</i>
Cardiovascular Disease & Stroke	6.73	6.25
Cancer	3.40	2.19
Accidents	0.92	0.14
All Other Causes	4.29	1.71

(U.S. Decennial life tables for 1989-91, vol. 1, no. 4, DHHS Pub. No. PHS-99-1150-4)

Then What Would Cause Death?



Aspects of the aging process would be the cause of death.

A new vocabulary would be required to describe causes of death attributable to the loss of physiological capacity in some vital organ.

Why Is Aging Not Determined by Genes?



Aging occurs spontaneously in both animate and inanimate objects as molecules lose their structural integrity and functional capacity with the passage of time.

Genes are unnecessary to drive a spontaneous process.

Example: Blueprints do not contain information on how to make a car age. For the same reason, the genome does not contain that information.

Three Conclusions:



1. Aging is not a disease, but the process increases vulnerability to disease.
2. The genome indirectly determines longevity by governing the energetics of molecules at sexual maturity and beyond. These molecules then age by incurring losses in fidelity.
3. Genes do not govern the aging process because it will occur without requiring instructions.

Extending Human Longevity



There is only one way in which this has been done by human intervention:

By delaying, slowing or eliminating causes of death attributable to disease or pathology.

Humans have never extended their longevity by intervening in either the determinants of longevity or in the aging process itself.

Anti-aging Medicine: Hype



Efforts to extend human longevity have been a part of our culture since a method was described for doing so in 3500 B.C.

Since then charlatans and snake oil merchants have enriched themselves by selling to a gullible public unproven potions, nostrums or life style modifications alleged to increase longevity.

Anti-aging Medicine: Hope



Those who hope to intervene in the aging or longevity determination processes fail to consider several unintended consequences:

1. When should intervention be done if you must live your entire life first in order to discover when life satisfaction is greatest?
2. What if your children and/or friends refuse or delay intervention? They could become older than you!

Anti-aging Medicine: Hope



3. Only the rich and powerful will have access first.
4. The millions who are poor, oppressed, or sick probably will not choose to increase their longevity.
5. Overpopulation will worsen.
6. All human institutions will be affected,- most negatively (retirement systems, work years extended).

Anti-aging Medicine: Reality



1. Intervening in either the aging or longevity determination process is not possible now.
2. The only method known to increase longevity is to delay, prevent or resolve diseases or pathology.
3. The limit is 15 years.
4. To go beyond that, intervention in the aging or longevity determination processes is necessary.