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Written testimony for the Subcommittee on Investigations and Oversight
“The Fountain of Youth? The Quest for Aging Therapies”

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Thank you for the opportunity to participate in these important hearings on a new public health initiative known within the community of scientists and health professionals as Geroscience. The story I’m about to tell you is an easy one to communicate because all of us are experiencing aging firsthand.

In the modern era most people in developed nations – and a rising percentage of people in developing nations – have the privilege of living a long life; a privilege denied to most throughout history. Pioneers in public health, medicine, and science from just a few generations ago gave us the gift of a long life; and since then, humanity has worked hard to maintain this privilege and extend it to others less fortunate.

Life expectancy increased from one year every one or two centuries for the previous several thousand years, to three years of life added per decade in the 20th century. The chances of surviving to ages 65, 85, and 100 have never been higher than they are now.

There is reason to declare victory in the pursuit of extended survival, but plenty of work remains to ensure this privilege is made available to everyone.

This longevity revolution came with a price. The modern rise of cardiovascular diseases, cancer, dementia, Alzheimer’s disease, and non-fatal impairments are byproducts of success – not failure. We just had to live long enough to see them. While risk factors hasten the emergence and worsening of these diseases, the biological processes of aging march on in the background – uninfluenced by treatments for diseases. Aging has become the most important risk factor for the diseases and disorders that occur today.

The quest for aging therapies discussed in this hearing is at the heart of a new public health paradigm that has been in the works for the last half century, but which has gained traction just within the last few years. Here’s the story in brief.

- Changes in our cells and tissues occur with the passage of time – we call it aging, but there is nothing magical about this since we see the same process occurring in our pets and automobiles.

- It was suggested in the 50s, 60s, and 70s that aging should eventually become the target of medicine and science, but too little was known at the time about how aging happens.
- Medicine and public health did what it could in the interim to devise ways to detect and treat diseases; one at a time; as if independent of each other. This was a logical next step in dealing with the diseases that appear in aging bodies, but this approach came with limitations that can best be thought of as a game of whack-a-mole; knock one disease down and another appears shortly thereafter. The longer we live, the shorter the distance between diseases.
- The science behind the “how” question in aging has advanced rapidly, which now makes it possible to pursue the gold standard in public health, which is to slow down aging itself rather than just treat its consequences.
- Geroscience has come of age. It is the culmination of decades of research. It is not a theoretical construct – it has been demonstrated in the laboratory that rate of aging can be modified in other species; which means rate control is possible in humans; the first clinical trials of aging therapeutics (known as Geroprotectors) are already underway; and the FDA is fully onboard with this approach; that is, to prevent disease by slowing aging.
- The health and economic benefits of Geroscience will be substantial. A cure for cancer would be welcome, but that’s just one disease of many that plague older bodies; and a cure for cancer would only add 3 years to life expectancy. A Geroprotector will simultaneously lower the risk of all fatal and disabling diseases of aging simultaneously, which means even a modest effect would yield amplified health benefits.
- The cost savings in health care alone would amount to over \$38 trillion for each year of life generated with Geroprotectors.
- The primary goal of Geroscience is the extension of healthspan, not lifespan, so these advances will not generate a “fountain of youth” in the colloquial sense; but it will fundamentally change what it means to grow old. We will remain younger longer; retain our youthful vigor for an extended period of time; and compress everything we don’t like about aging into a shorter duration of time at the end of life.
- There will be challenges that accompany the generation of a healthier and more robust older population, but the most precious commodity that many of us cherish most – our health – will be the gift of Geroscience.
- It is difficult to imagine any scenario in the future where the generation of a larger healthy older population would not be pursued – even if challenges appear along the way.
- This is just an introduction to Geroscience – I’ll be happy to take any questions you might have and thank you once again for the privilege of participating in this hearing. My written testimony will address all of these issues in far greater detail.

1.0 Executive Summary

1.1 The First Longevity Revolution

In the 20th century humanity initiated one of the most important developments in the history of public health. We transitioned from a world in which a fourth, and sometimes a third of the babies born in a given year died before reaching their first birthday, to a time when over 81 percent of babies born will reach ages 65 and older; 38 percent will reach age 85; and more people will live to 100+ than at any time in history.¹ Life expectancy at birth rose by 30 years in just one century – a stark contrast from the slow rise during the previous several thousand years that was punctuated often by episodic communicable diseases that led to high mortality and drops in life expectancy.

While there have always been some people throughout history that survived to what we now think of as old age, it has been a relatively rare event. The longevity revolution experienced since 1900 means that public health and modern medicine achieved its collective goal of opening the door to adulthood and old age for most.

1.2 Declaring Victory in the Pursuit of Life Extension

There are still disparities in survival that exist among population subgroups who do not have the same access to old age enjoyed by others. Harmful risk factors such as obesity, smoking, drug use, lack of physical exercise and unequal access to health care and quality food, and income inequality, among other factors, means there is still room to improve public health along a broad range of fronts, and these efforts should continue. But the overall goal of saving children from dying in their first few years of life, and a high probability of surviving to older ages for most, has been accomplished.

1.3 The Emergence of Biological Aging as a Primary Risk Factor

Aging bodies exhibit common attributes associated with using these living machines beyond what I consider their biological warranty period.² Even if we adopt what might be thought of as ideal lifestyles, and if all disparities could hypothetically be eliminated, our bodies would still age, we would still grow old, and most deaths would occur between the ages of 65-95 from the same causes of death we see today.

When medical professionals and public health experts inform us, correctly of course, that many diseases are preventable through lifestyle modification, what they don't tell us is that death is a zero-sum game. Aging related fatal and non-fatal diseases and disorders are not eliminated

¹ <https://mortality.org/>

² http://www.sjaylorshansky.com/sjo/Background_files/AmSci86-1998.pdf

through primary prevention – they are for the most part postponed and compressed into our remaining years of life.

If we are successful in reducing or eliminating one risk (such as smoking), we will no doubt reduce the risk of multiple diseases related to that risk, but biological aging marches on – uninfluenced by any progress made against specific diseases. Chronic age-related fatal and non-fatal diseases and disorders accumulate the older we get. This phenomenon is known as competing risks, and it is the reason why the life expectancy of national populations will not likely exceed about 85-88 years for men and women combined under present conditions.³

1.4 Rising Prevalence of Aging Related Conditions is a Product of Success, not Failure

The modern dramatic rise in the prevalence of heart disease, cancer, stroke, Alzheimer’s disease, osteoporosis, arthritis, vision and hearing impairments, etc. – are a product of success – not failure. We have to live long enough for these diseases to be expressed. The first longevity revolution in the 20th century accomplished its goal of redistributing death from the young to the old, but our longevity revolution came with a price⁴ – a Faustian bargain that exchanged longer lives for the diseases of aging.⁵

This longevity revolution made visible the diseases of aging. This means that the underlying biological processes of aging that give rise to these diseases, has become the most important risk factor for their emergence and severity. While behavioral and inherited risk factors still play a role in the onset and severity of the diseases of aging, they would still occur in us all even if optimal behavioral risk factors were adopted and all disparities eliminated.

Extended survival in the modern era has therefore presented itself as a unique public health dilemma never before experienced by humanity.⁶ In the last 50 years modern medicine has achieved great success in detecting and treating the diseases of aging; personalized medicine is advancing rapidly; genomics opens the door to hyper-personalized medical interventions; and reductions in health disparities and improved behavioral risk factors are at least theoretically achievable; but none of these advances in public health currently have or will have any influence on the underlying biological processes of aging that give rise to diseases common in old age. The aging of our bodies is uninfluenced by any of these achievements, and it is this dilemma that is being addressed by the emergence of Geroscience.

³ http://www.eurohex.eu/bibliography/pdf/1297018782/Olshansky_1990_Science.pdf

⁴ http://www.sjayolshansky.com/sjo/Background_files/PROJECT%20M_JAY.pdf

⁵ <https://europepmc.org/article/med/29238709> [click on “open pdf”]

⁶ https://www.researchgate.net/profile/S-Olshansky/publication/274167075_The_Longevity_Dividend/links/5ba791e445851574f7e01e1e/The-Longevity-Dividend.pdf

1.5 The Emergence of Geroscience⁷

It was believed until recently that the aging of living things was immutable – an inevitable byproduct of extended survival. It has since been discovered that there can be no aging or death programs built into our genome that leads to programmed obsolescence; the rate of biological aging varies dramatically between individuals (e.g., biological time varies between individuals while clock time is constant); evidence has emerged demonstrating that biological aging in humans and other species is inherently modifiable; and importantly, the first clinical trials testing potential therapeutic aging interventions are already underway.^{8,9,10}

Delayed aging through a variety of interventions has already been accomplished in other species by scientists working in Geroscience. Given the common theme of how selection operates across species, there is abundant evidence that aging modification is possible in humans.¹¹

These discoveries about aging have now made it possible to formulate and deploy an entirely new approach to public health known as Geroscience. *The premise is straightforward. Instead of preventing or treating each fatal and disabling disease of aging as if it had an independent etiology and progression, Geroscience targets all of them at the same time – with a single intervention.* Indeed, it's possible to have more than one “single intervention” – but each Geroprotector would be expected to have a systemic effect on all aging systems in the body. Given the absence of aging or death programs driven by our genes, this means that multiple Geroscience-developed therapeutics are possible. Scientists involved in advocating for Geroscience are acutely aware of the broad range of potential therapies, and they're aggressively pursuing all of them at the same time.

I have referred to the importance of Geroscience to the modern era of public health as Primary Prevention with A Capital P.¹² Medicine and public health professionals have been advocating for primary prevention for decades – the end result of which is well-established improvements

⁷ <https://www.afar.org/imported/fall2013ppar.pdf> [the entire issue of Public Policy & Aging Report is devoted to explaining the origins of Geroscience]

⁸ https://www.amazon.com/Aging-Longevity-Dividend-Collection-Perspectives/dp/1621820807/ref=sr_1_1?crd=11WJZ2LNR4JL1&keywords=aging+the+longevity+dividend&qid=1663003179&srefix=aging+the+longevity+dividend%2Caps%2C80&sr=8-1&ufe=app_do%3Aamzn1.fos.006c50ae-5d4c-4777-9bc0-4513d670b6bc

⁹ https://www.researchgate.net/profile/Julia-Rowland-2/publication/262386365_Advances_in_Geroscience_Impact_on_Healthspan_and_Chronic_Disease/links/548f1c910cf225bf66a7fb95/Advances-in-Geroscience-Impact-on-Healthspan-and-Chronic-Disease.pdf

¹⁰ <https://books.apple.com/us/book/a-measured-breath-of-life/id604410007>

¹¹ <https://link.springer.com/book/10.1007/978-3-319-23246-1>

¹² https://www.researchgate.net/profile/S-Olshansky/publication/274167075_The_Longevity_Dividend/links/5ba791e445851574f7e01e1e/The-Longevity-Dividend.pdf

in *healthspan* (the number and proportion of the years of life spent in good health). As such, foundational support for Geroscience was spawned in the early 20th century as the detection and prevention of disease has always been the gold standard of how public health operates most efficiently.

Geroscience and the therapeutic interventions being pursued should therefore best be thought of as highly efficient methods of accomplishing what modern medicine is already trying to achieve – good health at every age. Geroscience will achieve this end with far greater efficiency because a single intervention will target multiple disease endpoints – simultaneously.

It has been suggested that healthy life experienced by older people might be one of the most precious commodities that exist.¹³ I contend that healthspan has always been the primary goal of medicine and public health.

This combined body of knowledge has led researchers in the field of aging and a broad range of health professionals from physicians to health economists, to propose a new paradigm in public health designed specifically to address the modern dilemma of a rising prevalence of aging related diseases. I have explained the entire concept of Geroscience using just 300 words.¹⁴

1.6 What Might Happen to Public Health in the Absence of Geroscience?

It has been suggested that in the absence of Geroscience and an effective therapeutic, it's possible that the current model of treating diseases one-at-a-time as if independent of each other, could lead to rapid increases in chronic disease prevalence in the coming decades.¹⁵ Disease management in an aging world without Geroscience, then becomes an ever more rapid game of whack-a-mole where each disease knocked down independently, leads to multiple other aging related diseases popping up shortly thereafter.

Aging and life extension without Geroscience could lead to a dramatically rising prevalence of aging related conditions.¹⁶ We should then expect escalating health care costs associated with detecting and treating multiple aging related diseases that appear closer together in the last decades of life.

1.7 What is The Goal of Geroscience

To extend healthspan by compressing the frailty and disability that comes with aging, into a shorter duration of time near the end of life. What would a successful Geroscience therapeutic do for us? The life and death of Queen Elizabeth II is an exemplar of what Geroscience is pursuing – a healthy active life with a short period of frailty at life's end. Conceptually, think of

¹³ https://academic.oup.com/gerontologist/article/56/Suppl_2/S167/2605367

¹⁴ <https://www.dropbox.com/s/en3zn6b8y0ghohb/300%20WORDS.mov?dl=0>

¹⁵ <https://journals.sagepub.com/doi/abs/10.1177/089826439100300205>

¹⁶ <https://www.frontiersin.org/articles/10.3389/fmed.2017.00215/full> [click on “download article”]

it taking 80 years of clock time to become biologically 60-year-old; or 90 years of clock time to become biologically age 70. Extending healthspan is the primary goal, and the cost savings associated with a successful Geroprotector that yields just a one-year increase in life expectancy would be \$38 trillion.^{17,18} **Geroprotectors are not the “fountain of youth”; but they will fundamentally change what it means to grow old.**

¹⁷ <https://www.escueladepensamiento.org/wp-content/uploads/2021/08/s43587-021-00080-0.pdf>

¹⁸ <https://www.proquest.com/openview/88e55a15d518b155e010620da1e0b3cb/1?pq-origsite=gscholar&cbl=4365298>

2.0 Common Questions and Challenges to Geroscience

2.1 Will Geroscience be the Fountain of Youth?

No. If the concept of a fountain of youth is taken in its literal sense as that presented in the popular literature where we become younger versions of ourselves by using some intervention, this is not going to happen in my view. There are many instances of exaggeration and embellishment among some in the scientific and medical community regarding the use of this phrase – some of which is driven by those seeking to profit from these therapies or research dollars from investors – but most researchers in the field stay away from mentioning “fountain of youth” in the same sentence as Geroscience.

Reversing some of the signs and symptoms of aging and lowering the risk of death and frailty is already possible with the use of diet, exercise, and risk factor modification – but there are limits to how much these kinds of interventions can influence lifespan and healthspan.

If “fountain of youth” is interpreted to mean that we can alter the age trajectory of mortality and disability through scientific means that have been properly tested for safety and efficacy, then under these conditions the phrase may be appropriate.

Those of us involved in Geroscience are acutely aware of a long history of hucksterism that has followed medicine and public health for thousands of years,¹⁹ so most shy away from using this phrase. I personally avoid using this phrase, just as I avoid the phrases “age reversal” and “immortality”.

I view Geroscience as the next logical paradigm in public health that will simultaneously avoid the dangers of life extension brought forth by treating one disease at a time and enhance the probability that healthspan will be extended and morbidity and disability compressed.

2.2 If We Delay Aging, Aren’t We Just Pushing the Same Health Challenges to Later Ages?

The focus of Geroscience is healthspan extension, not lifespan extension. I’ve referred to the time period later in life when frailty and disability rise exponentially as the “Red Zone.”²⁰ The first longevity revolution enabled large segments of every birth cohort in the last few generations to live into older ages, but the price paid for this success is a rising prevalence of diseases expressed in this period of the lifespan.

The current medical model is designed to push even more people into the Red Zone one disease at a time. By contrast, the focus of Geroscience is to compress the Red Zone, not extend life. As

¹⁹

https://books.google.com/books?hl=en&lr=&id=LM00AwwAAQBAJ&oi=fnd&pg=PP1&ots=NPN2d_tbaa&sig=Ib6fid2BVLyjnfbpJ4KwqA1hCjk#v=onepage&q&f=false

²⁰ <https://jamanetwork.com/journals/jama/article-abstract/2703114>

such, Geroprotectors are expected to generate fewer years of frailty and disability for each successive generation.

Health challenges associated with survival into later ages would therefore be delayed **and** compressed rather than just postponed. Geroscience is being developed for the combined effect of healthspan extension and disease compression.

2.3 Would Extended Healthspan Reduce Future Healthcare Spending?

Rather than using my own words here, I'm going to include the abstract to an article recently published that explains how much health care costs would be reduced through the use of a Geroprotector.²¹

“Developments in life expectancy and the growing emphasis on biological and ‘healthy’ aging raise a number of important questions for health scientists and economists alike. Is it preferable to make lives healthier by compressing morbidity, or longer by extending life? What are the gains from targeting aging itself compared to efforts to eradicate specific diseases? Here we analyze existing data to evaluate the economic value of increases in life expectancy, improvements in health and treatments that target aging. We show that a compression of morbidity that improves health is more valuable than further increases in life expectancy, and that targeting aging offers potentially larger economic gains than eradicating individual diseases. We show that a slowdown in aging that increases life expectancy by 1 year is worth US\$38 trillion, and by 10 years, US\$367 trillion. Ultimately, the more progress that is made in improving how we age, the greater the value of further improvements.”

2.4 Would Extended Healthspan Create Challenges for Age Entitlement Programs?

The number of healthy older people would rise in this century with the dissemination of Geroprotectors, creating challenges for age entitlement programs such as Social Security and Medicare, although per capita medical costs would decline.²² Exhibit 4 in this reference indicates the magnitude of the financial challenge, but the authors argue that adjusting the eligibility ages for these programs would address the challenge. A quote from that article appears below where this issue is addressed head on:

“Given the large social return, the question then becomes how we could accommodate these changes fiscally. Several policy measures might achieve fiscal balance—we demonstrate one involving eligibility changes—but a full evaluation of the options is beyond the scope of this research. However, we note here one benefit of delayed aging that might enlarge the set of possibilities: With people staying healthy until a much later age, it might be more feasible to justify raising the eligibility age for public programs for seniors. Arguments against doing so often note that life

²¹ <https://www.escueladepensamiento.org/wp-content/uploads/2021/08/s43587-021-00080-0.pdf>

²² https://commed.vcu.edu/Chronic_Disease/aging/2014/delayingaging.pdf

expectancy increases in lower socioeconomic groups have lagged far behind those in better-off groups. A future in which delayed aging increased the health of all socioeconomic groups would make these increases in eligibility ages more palatable.”

2.5 Is Geroscience a Form of Enhanced Primary Prevention – An Approach to Aging Related Diseases that is Already Accepted and Advocated Across the Globe?

Yes. If health promotion and disease prevention is the mantra of medicine and public health, then Geroprotectors represent an enhanced or amplified version of desirable interventions that help us deal with aging bodies and minds.

However, instead of treating health conditions as they arise (again, the concept of competing risks linked to modern medicine), Geroprotectors are designed to postpone the need for all health interventions at once. If it is desirable to avoid taking statins or medications to treat diabetes or repair worn out knees and hips or avoid cancer treatments or cardiovascular interventions, then Geroprotectors offer the most comprehensive method of achieving these goals.

2.6 Is it Selfish for Long-Lived Countries to Seek Aging Interventions when Other Countries Still Suffer from Communicable Diseases?

No. Just because different countries are on different health and longevity trajectories, does not mean those already able to survive to later ages, should wait until all other countries catch up before seeking out more efficient ways to combat disease. Besides, ongoing efforts to combat communicable diseases in developing nations are designed specifically to enable larger segments of these populations to live long enough to experience aging. Keep in mind that older individuals with aging related health conditions exist in all nations, regardless of whether they have a lower life expectancy than average. All nations – developed and developing alike – will benefit from the development of Geroprotectors. There is also reason to believe that disadvantaged subgroups of the population that suffer from chronic age-related diseases may benefit more from Geroprotectors given their higher risks to begin with.

2.7 When Should we Expect Physicians to Prescribe a Safe Geroprotector?

No one can know the answer to this question. What we do know is that Phase I clinical trials are already underway to test one or more Geroprotectors in humans – so this is no longer a hypothetical exercise. If the level of funding for Geroscience ramps up as expected, we can anticipate accelerated results from these clinical trials. I’m optimistic enough to suggest that most people alive today will be using one or more Geroprotectors in their lifetime, and they will be presented to the public as treatments for specific diseases – with the suggestion that their influence could extend to multiple disease endpoints. Metformin is a good example. While Metformin is used to treat diabetes, it appears to have desirable side effect of lowering the risk of a range of fatal conditions, but the clinical trials have yet to start to test this hypothesis.

2.8 Will the FDA approve an intervention that targets aging?

Members of the scientific community met with the FDA in 2016 to discuss how clinical trials would need to be organized to test for and ensure safety and efficacy for the public when using Geroprotectors.^{23,24} While the FDA normally operates by linking one treatment to one disease, they recognized the value in targeting multiple disease endpoints by modifying the biological aging processes and fully support this new paradigm of primary prevention. The FDA has been supportive of Geroscience by advising scientists on how to structure clinical trials to test for the safety and efficacy of Geroprotectors. The primary FDA goal of ensuring safety and efficacy would apply equally to the testing and use of Geroprotectors.

2.9 Will Geroprotectors be Safe?

Geroprotectors will need to go through clinical trials just like any other purported therapeutic intervention designed to treat health conditions. These interventions should not make their way into physician-advised treatment/prevention protocols until they're fully cleared by the FDA to be safe and efficacious.

Having said this, scientists in our field need to remain vigilant since it is a common practice for unscrupulous entrepreneurs to try and manufacture and sell aging interventions before the clinical trials are completed.

2.10 Can Geroscience Replace Diet, Exercise, and Risk Factor Control?

No. Taking a Geroprotector is not a license to adopt an unhealthy lifestyle. The same behavioral risk factors that shorten life and increase the risk of disease would be operational when using a Geroprotector.

Geroprotectors would likely enhance and extend to older ages the effectiveness of diet and exercise and risk factor control in extending healthspan and compressing morbidity and disability.

2.11 Would Geroscience Create Environmental Challenges?

I've heard comments like this over the years, but never understood the logic. If Geroprotectors yield more years of healthy life, I cannot think of a single condition in which the global environment would be challenged by such a desirable event. Perhaps population size would be marginally larger in the coming decades as death rates decline and frailty and disability are delayed and compressed, but the momentum for population growth is already built into the age structure of our species.²⁵ The additional person-years-of-life generated by Geroprotectors

²³ <https://www.dropbox.com/s/41enksum78r3l55/Clip%201.mov?dl=0>

²⁴ <https://www.dropbox.com/s/55htnsisaso4x11/Clip2.mov?dl=0>

²⁵ https://d1wqtxts1xzle7.cloudfront.net/49129129/The_aging_of_the_Human_Species20160926-30708-mb5jzd-libre.pdf?1474897147=&response-content-disposition=inline%3B+filename%3DThe_aging_of_the_Human_Species.pdf&Expires=1663013961&Signatu

would be noise compared to the population growth that is already destined to occur by mid-century.

2.12 Would Geroscience Accelerate Population Growth, Leading to Overpopulation?

No. As indicated, the momentum that will lead to a human population of about 9-10 billion by 2050 is an inevitable byproduct of past trends in fertility – referred to as momentum for population growth already built into the age structure. Even if death rates were to decline as a result of Geroprotectors, the effect on the growth rate of the population would be almost imperceptible.²⁶ Please keep in mind that Geroprotectors are not designed for life extension; they're designed to extend healthspan and compress frailty and disability. The link between Geroprotectors and global population growth is negligible.

2.13 Is Aging a Disease?

This is a point of contention in the field of aging. By declaring aging a disease, some believe it will be easier to get the FDA to approve targeted therapeutic interventions. Others, myself included, suggest that aging is no more of a disease than puberty or menopause – it is a natural developmental byproduct of operating our living machines long enough to witness its effects. Calling aging a disease implies that all older people are, by definition, diseased – which is an example of ageism. We're not against aging or growing older – which is what the 'aging disease' designation implies by default. What we are seeking to achieve is an extension of the period of healthy life. Declaring aging a disease is just not necessary to launch this new movement in public health.

Besides, the FDA has already approved Geroprotectors to target multiple disease endpoints all at once, without declaring aging a disease.

2.14 Does Geroscience Intervene in God's Will?

Some critics suggest that the fundamental goal of Geroscience is to tamper with mother nature or god's will, and that we should not be pursuing such efforts. But virtually all of public health is designed to tamper with our external and internal environments in one way or another to seek out ways to allow our bodies and minds to operate more efficiently and with less disease. For example, dentistry taught us how to make our teeth last longer; vaccinations are designed to use the body's own defense mechanisms to combat communicable diseases; antibiotics enable us to combat bacterial infections that used to kill with regularity; diet and exercise are the body's equivalent of an oil, lube, and filter for your car (it's not required in either case, but we now

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²⁶ <https://www.afar.org/imported/fall2013ppar.pdf> [see Table 1 on p.5]

know that our cars and bodies operate more efficiently when done); surgical procedures that remove the gall bladder or appendix or the use of stents to treat cardiovascular disease or knee and hip replacements are all designed to combat “natural” bodily functions that are harmful; and the dissemination of medications as simple as aspirin or statins that are designed to help the body overcome immediate challenges – all together, among many other examples of “tampering” with how are bodies operate, represent forms of interfering with natural processes ongoing in the body. If one is critical of Geroscience, then they should not avail themselves of all of the other medical interventions described here that are designed to combat disease or treat and prevent the health challenges that come with extended survival.

Should someone not feel inclined to use Geroprotectors because it would violate their personal beliefs, they have the option to not use such interventions. Seventh Day Adventists adhere to this line of reasoning.

For those who wish to avail themselves of the tools of science and medicine to combat disease and extend healthspan, Geroscience will place into their physician’s hands, what might be thought of as one of the most comprehensive tools ever developed by modern medicine to combat all of the diseases of aging simultaneously.

2.15 Are There Secondary Benefits Associated with a Successful Geroprotector?

If Geroprotectors had been available at the beginning of the Covid-19 pandemic, it would likely have dramatically reduced death and disability related to this communicable disease? Why? Because Covid-19 and other communicable diseases prey on subgroups of the population that are experiencing multiple health challenges (e.g., pre-existing conditions) – the very phenomenon of competing risks described earlier that explains why this virus tends to kill most effectively at older ages. The declining effectiveness of our immune system is one of the hallmarks of biological aging, so any intervention that delays the process of aging, will have secondary benefits associated with multiple infectious diseases including pneumonia and seasonal influenza, among others.

Geroprotectors will also likely be needed for astronauts that travel for extended periods in space due to high risks associated with exposure to radiation.

It is difficult to determine this far in advance what other attributes of human health might benefit from Geroprotectors, but it is safe to say that any intervention that enables us to slow down biological aging is likely to have as yet unforeseen benefits.

It is difficult to imagine any harm to human health that would follow from interventions that yield more healthy years of life.