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## Redefining Aging: Proposing 'Senescence Syndromes' as a Multidimensional Framework and New Name for Gerontology

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### Abstract

Redefining the concept of aging is crucial for advancing gerontological research and healthcare practices. In this paper, we propose a new framework, 'Senescence Syndromes,' to more accurately reflect the multidimensional nature of aging. Traditional perceptions of aging often misclassify it as a disease, oversimplifying its complex biological underpinnings and societal implications. By reconceptualizing aging through a lens of various interrelated biological processes, such as antagonistic pleiotropy, damage accumulation, and molecular heterogeneity, we challenge these oversimplified views. This reconceptualization is not just semantically significant but also crucial for developing more effective medical interventions and healthcare strategies. Moreover, our proposed framework addresses the societal issue of ageism and its psychological impacts on older adults. We emphasize the importance of resilience in combating ageism, highlighting how societal perceptions directly influence the well-being of the aging population. Adopting the 'Senescence Syndromes' perspective can revolutionize our approach to aging, leading to research and treatments that enhance both the healthspan and

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lifespan of individuals. This shift in perspective holds the potential to transform healthcare policies and societal attitudes, making it a critical consideration for future gerontological research funded by institutions like the NIH.

## Keywords

Aging; Senescence syndromes; DNA damage; Ageism; Healthcare

## Introduction

Introduction Aging, a fundamental aspect of the human experience, is traditionally perceived as a natural inevitable process distinct from disease. However, this viewpoint is increasingly challenged by advancements in scientific understanding, prompting a reconsideration of how aging is conceptualized and classified [1,2]. The importance of accurate nomenclature in aging is not merely semantic but has profound implications for research, healthcare, and societal attitudes towards the elderly [5,6].

In this paper, we propose a paradigm shift by introducing the term 'Senescence Syndromes' as a new framework for understanding aging. This concept aims to move beyond the binary classification of aging as either a natural process or a disease, recognizing it as a complex multifaceted phenomenon. The 'Senescence Syndromes' framework encompasses a range of biological processes— including antagonistic pleiotropy, damage accumulation, molecular heterogeneity, and metabolic imbalance each contributing to the aging narrative [1,2].

Our proposition challenges the traditional perceptions of aging, underscoring the need for a more nuanced understanding that aligns with the latest scientific insights [1,2]. We argue that redefining aging as 'Senescence Syndromes' allows for a more targeted approach to medical interventions, enabling healthcare strategies that are more responsive to the diverse manifestations of aging.

Additionally, we address the societal issue of ageism. This pervasive form of discrimination against older adults not only perpetuates stereotypes but also has tangible consequences on their psychological well-being [11,12]. By integrating the concept of resilience, we highlight the role of psychological and social factors in the aging process, advocating for a comprehensive approach that encompasses biological, psychological, and societal dimensions.

Through the lens of 'Senescence Syndromes', we aim to contribute to a more comprehensive and nuanced understanding of aging. Recognizing aging as a complex process with distinct cellular and molecular underpinnings [1-2], we seek to pave the way for innovative approaches to healthcare and the well-being of older adults, fostering a society that respects and values the aging population.

## Aging as a Natural Process

The traditional view of aging as a natural, inevitable progression distinct from disease is undergoing a paradigm shift. Recent scientific advancements have illuminated aging as an interconnected web of biological mechanisms and pathologies. This perspective, as explored by David Gems in "The Aging-

Disease False Dichotomy: Understanding Senescence as Pathology" [1,2], aligns with our proposed nomenclature of 'Senescence Syndromes.' It moves beyond the simplistic dichotomy of aging versus disease, presenting aging as a complex process that is intimately linked with pathological changes over time.

The theory of 'antagonistic pleiotropy,' which Gems discusses, underscores the complexity of aging. It suggests that genetic factors influencing aging may have dual effects-beneficial early on but potentially deleterious later, contributing to age-related diseases. This duality is a cornerstone of the 'Senescence Syndromes' concept, which posits that the aging process is not uniform across individuals but is a syndrome—a cluster of symptoms and signs that can vary widely among the population.

Further, Gems' focus on cellular senescence, DNA damage, and inflammation highlights the various mechanisms that can lead to what might be classified under 'Senescence Syndromes.' Cellular senescence and the resultant tissue dysfunction, accumulated DNA damage, and chronic inflammation are processes that could be addressed individually within the broader category of 'Senescence Syndromes,' allowing for more targeted therapeutic approaches [2,3].

The interconnectedness of aging and disease mechanisms suggests that interventions could be developed to target specific aspects of 'Senescence Syndromes,' with the potential to mitigate or reverse the effects of aging. This recognition of aging as a condition influenced by multiple identifiable factors fits well with the 'Senescence Syndromes' framework, which seeks to redefine how we approach aging in both research and clinical settings.

In summary, the insights provided by David Gems [2,3] advocate for a nuanced understanding of aging that are in line with the 'Senescence Syndromes' proposition. It reinforces the view that aging should not be seen as an inexorable decline but as a series of complex interrelated processes that can be studied, understood, and potentially managed, offering a new horizon in our quest to improve human health span.

### **Aging and Disease Interconnection**

Recognizing the intricate web of biological mechanisms that constitute aging is pivotal for gerontological advancement. David Gems' pivotal work, "The Aging-Disease False Dichotomy: Understanding Senescence as Pathology" [4], lays the scientific foundation for our 'Senescence Syndromes' framework. This new framework transcends the traditional aging versus disease dichotomy by presenting aging as an intimately disease-interlinked process, not merely a natural decline.

The 'antagonistic pleiotropy' theory, as Gems elucidates, reveals the dual nature of genetic influences on aging-beneficial in youth but often detrimental in later life, leading to age-related diseases [4]. This genetic complexity fortifies the 'Senescence Syndromes' proposition, emphasizing that aging is a variable, non-uniform process across individuals.

Gems' emphasis on cellular senescence, DNA damage, and inflammation underscores the multifactorial mechanisms that contribute to the 'Senescence Syndromes' concept [4]. By identifying and targeting these individual mechanisms, we can tailor interventions more precisely, diverging from traditional, less-

specific aging treatments.

The interconnection between aging and disease mechanisms opens the door for developing interventions aimed at specific 'Senescence Syndromes,' potentially altering the course of aging itself. This proactive approach is at the heart of 'Senescence Syndromes,' advocating for a healthcare model that is responsive to the complex, identifiable factors influencing aging [4].

In conclusion, the insights from David Gems [4] bolster the case for a nuanced, multidimensional understanding of aging, central to the 'Senescence Syndromes' framework. This perspective not only enriches scientific discourse but also promises a revolution in how we manage aging and age-related diseases, heralding a new era in improving human health span.

### **Reclassifying Aging as a Disease**

The lively debate on reclassifying aging as a disease, as presented by Sven Bulterijs et al. [5-6], dovetails with the 'Senescence Syndromes' initiative, advocating for a refreshed nomenclature that reflects our dynamic understanding of aging. The historical symptom-based categorization of diseases has often overlooked aging, considering its universality and gradual onset. Yet, the advancements in our scientific comprehension of aging suggest that it is time to account for its complex underlying mechanisms, a perspective that 'Senescence Syndromes' encapsulates.

[5] argue for acknowledging aging akin to conditions like sarcopenia, osteoporosis, and hypertension, which are widespread yet characterized by specific pathologies and acknowledged as diseases [5-6]. This reclassification would not only validate medical interventions aimed at aging but also bolster research funding, echoing the proactive ethos of 'Senescence Syndromes' that seeks to actively manage aging.

Envisioning aging as a disease carves out new avenues for research and therapeutic development, including geroprotective and regenerative therapies aimed at aging's root causes. This approach is fundamental to the 'Senescence Syndromes' framework, which posits that through targeted interventions, the impacts of aging can be ameliorated, thus enhancing elderly well-being and addressing the broader challenges of aging populations.

In conclusion, the argument by [5-7] to reclassify biological aging as a disease aligns with and bolsters the 'Senescence Syndromes' nomenclature. It underscores the imperative to adapt healthcare policies and research priorities to this new understanding, portraying aging as a treatable condition. This shift calls for a holistic reevaluation of aging within the medical community and society, in sync with the objectives of 'Senescence Syndromes,' thus enriching the discourse on aging and encouraging the development of a more nuanced healthcare strategy.

### **Aging Reversal and Interventions**

Adiv A. Johnson and colleagues' in-depth exploration of aging reversal in "Human age reversal: Fact or fiction?" [8] signifies a critical shift towards perceiving aging as a modifiable process. Their work is particularly salient to our 'Senescence Syndromes' framework, which similarly views aging not as an immutable decline but as a series of conditions amenable to intervention.

Central to this research is the concept of biological aging clocks, like the epigenetic clock, which serve as indicators of an individual's biological age through markers such as DNA methylation patterns. These insights are instrumental to 'Senescence Syndromes', providing a method to quantify and potentially

modulate the biological facets of aging.

The interventions reviewed by Johnson and colleagues, ranging from lifestyle changes to pharmacological agents, align with the 'Senescence Syndromes' ethos of proactive and precise intervention [8-10]. The promising results from preclinical and clinical studies underscore the philosophy of 'Senescence Syndromes': that the processes of aging can be decelerated, and healthspan consequently prolonged, by specifically addressing mechanisms like cellular damage and metabolic dysregulation.

Acknowledging the nascent stage of this research, the body of evidence nonetheless fortifies the 'Senescence Syndromes' approach, advocating for a shift in our perception of aging—from an inevitable fate to a manageable condition.

In summary, findings [8-10] highlight the latent potential in intervention-based approaches to aging. They envision a future where aging is not merely deferred but enhanced, epitomizing the 'Senescence Syndromes' vision. By emphasizing interventions that influence biological aging clocks, their research supports the notion that aging can be a strategic and controlled journey, thus enriching the aging discourse and affirming the practicality of the 'Senescence Syndromes' nomenclature.

### **Ageism and Psychological Well-being**

Ageism, with its prejudicial roots, significantly hinders the psychological well-being of older adults. The systematic review by Kang and Kim [11-12] provides compelling evidence of the detrimental effects of ageism on mental and emotional health, linking it to negative emotions, diminished self-esteem, and heightened stress and anxiety. These factors collectively undermine the life quality of older individuals.

[11-13] highlight that the psychological burden of ageism varies among older adults, with those who maintain a positive outlook and exhibit resilience being less affected. This variability resonates with the 'Senescence Syndromes' philosophy, which posits that aging is a deeply personal experience shaped by a myriad of factors, including societal attitudes and individual perspectives.

The evidence underscores the importance of integrating anti-ageism strategies into the 'Senescence Syndromes' framework. Such strategies must go beyond addressing the biological aspects of aging to encompass psychosocial support. Tackling ageist stereotypes, promoting intergenerational relationships, and nurturing respect and inclusion are critical components of this approach.

Initiatives informed by 'Senescence Syndromes' are vital in ensuring the psychological aspects of aging are not neglected. These could include educational campaigns to dispel aging myths, policy reforms that encourage intergenerational solidarity, and building supportive social networks for the elderly. Such comprehensive interventions align with 'Senescence Syndromes' advocacy for a respectful and inclusive model of aging.

Incorporating the issue of ageism and its psychological impacts into the aging narrative affirms the all-encompassing nature of 'Senescence Syndromes.' As supported by Kang and Kim's review [11-14], 'Senescence Syndromes' champions a dignified approach to aging, treating mental health and social well-being as essential to the overall wellness of older adults.

## Resilience in Countering Ageism

Research [15] into resilience provides critical support for 'Senescence Syndromes' as a multifaceted approach to aging. Recognizing the intricate interplay of biological, psychological, and social factors, 'Senescence Syndromes' champions resilience not only as a trait but as an essential component for seniors to overcome societal challenges such as ageism.

The findings underscore the imperative of weaving psychosocial factors into the 'Senescence Syndromes' framework. Interventions designed to bolster social connections, engage seniors in meaningful activities, and promote positive aging perceptions are fundamental to fostering resilience. Such interventions, resonating with 'Senescence Syndromes', offer a more nuanced care strategy that extends beyond physical health to embrace mental well-being.

Moreover, 'Senescence Syndromes' advocates for developing programs that enhance resilience, such as dismantling ageist prejudices and fostering older adults' integration into society. Healthcare practices that prioritize mental health support as an integral part of geriatric care embody this ethos.

By integrating resilience at its core, 'Senescence Syndromes' envisions an empowered, dignified aging experience. The commitment is to a future where aging is navigated with proactive support and empathy, honoring the diverse experiences of older adults. The 'Senescence Syndromes' nomenclature is a call to action for society to reshape the aging narrative—one that transcends decline and celebrates the enduring capacity for growth and contribution. Thus, the insights from Ribeiro-Gonçalves et al. [14-15] are pivotal, showcasing how resilience can underpin a holistic, life-affirming approach to aging within the 'Senescence Syndromes' framework.

## Conclusion

Our journey through the intricacies of the aging process culminates in a bold call to adopt 'Senescence Syndromes' as a transformative nomenclature, signifying a pivotal paradigm shift. This reconceptualization encourages us to move beyond viewing aging as an inevitable natural progression, advocating for its recognition as a multifaceted, actionable phenomenon. The resulting framework does not merely challenge traditional wisdom but promises a new epoch of precise, personalized interventions designed to extend health span and improve the overall quality of life.

The advocacy for reclassification, as promoted by scholars like [3], while intellectually invigorating, brings with it the need for a comprehensive evaluation of the social, ethical, and cultural implications. It urges us to consider how redefining a natural life stage impacts our societal constructs and healthcare policies. Despite the inherent challenges, the adoption of 'Senescence Syndromes' holds the potential to revolutionize gerontological research and intervention development, facilitating a future where aging is not feared but managed with finesse.

As we embrace this new framework, we must also remain acutely aware of the scourge of ageism, which continues to undermine the mental and emotional well-being of the elderly. The work by Kang and Kim

[5] reminds us that our interventions must extend beyond the physical, incorporating strategies to counteract ageist prejudices and foster a culture of inclusivity and respect.

In conclusion, the 'Senescence Syndromes' proposition is more than a mere semantic evolution; it is a comprehensive call to action. It beckons us to revisit and reshape our understanding of aging and disease, unlocking unprecedented avenues for innovative healthcare strategies. As we navigate this transformative landscape, our focus must also encompass the psychological health of older adults, confronting ageism, and nurturing resilience. By adopting this all-encompassing approach, we not only enhance the longevity of our elders but also ensure that those years are lived with dignity, purpose, and fulfillment, truly enriching the tapestry of our aging society.

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