Opinion

BIOMEDICAL Journal of Scientific & Technical Research

ISSN: 2574 -1241

DOI: 10.26717/BJSTR.2023.50.007969

Addressing Aging and Its Associated Diseases: Conceptual Challenges

Amal Kassab*

Biomedical Technology and Cell Therapy Research Laboratory, Department of Biomedical Engineering, Faculty of Medicine, McGill University, Canada

***Corresponding author:** Amal Kassab, Biomedical Technology and Cell Therapy Research Laboratory, Department of Biomedical Engineering, Faculty of Medicine, McGill University, 3775 University Street, Montreal, QC H3A 2BA, Canada

ARTICLE INFO

Received: May 10, 2023

Published: May 22, 2023

Citation: Amal Kassab. Addressing Aging and Its Associated Diseases: Conceptual Challenges. Biomed J Sci & Tech Res 50(3)-2023. BJSTR. MS.ID.007969.

Opinion

Advancement in aging and rejuvenation studies have been progressing exponentially with amazing results in animal models [1,2] and, on a smaller scale, in some human organs like the corneas [3]. Today, it is accepted that aging can be reversed and that it has a set of biological metrics in addition to its de facto association with several chronic conditions in the adult population. However, aging is yet to be classified as a disease, since "disease" as defined in the Oxford dictionary is "a disorder of a structure or function in a human, animal or plant, especially one that has a known cause and a distinctive group of symptoms, signs or anatomical changes." As such, while the structural disorder associated with aging on a molecular and cellular levels has been well documented [4], it still lacks a distinct group of symptoms, signs and anatomical changes between all people of the same age group. Therefore, no direct link can be formed between anticipated disease signs with any given age, but merely a higher statistical probability, which demotes "aging" into a risk factor. This piece argues that in spite of such delineation, after considering the factors associated with aging, its pathology and physiological changes accompanying it, aging can be considered as a progressive disease responsible of a wide subset of chronic conditions. The importance of such a definition lies in amending the approach towards aging research as well as the target and scope of clinical interventions.

Does Aging Refer to an Age Group?

Aging studies today are concerned by maladies mostly associated with the above 60 age group, particularly those with debilitating consequences. Thus, neurological disorders are highly targeted, while other diseases, such as cardiovascular, diabetes and even cancer, are generally studied separately without referencing the role that a patient's age might have in its development. However, the number of diseases, including chronic conditions, increase exponentially with age. The fact that younger patients with similar diseases exist should not detract from the role an aging system plays in accommodating their pathology. This brings about the first important distinction that must be drawn with regards to aging. Aging studies should not target a distinct age group, rather it is a disease that increases exponentially with age, the pathology starts at the late thirties and early forties in most people and builds up with time. As such, any interventions targeted to an age group above 60, to mitigate disease manifestations can be mostly cosmetic in nature. Based on numerous studies using heterochronic parabiosis, aging is shown to be due to not yet fully identified circulating factors [5,6]. In principle, accumulation of "toxins" in plasma with age leads to deregulation in cellular signaling, even in young mice sharing blood circulation with an older companion [7]. The variation in disease manifestation between different individuals of a given age group can be due to a delay in the onset of aging, a more genetically robust system or a

healthier diet and lifestyle. Thus, clearing the blood stream from such toxins can have positive effects with regards to aging [8], however, understanding the reason behind such an event can potentially have a much more lasting effect. Moreover, once aging "initiators" are identified, they can be targeted individually using various cellular reprogramming techniques in order to restore their functionality [9]. There have been some recent studies that propose specific organs as initiators of aging, such as the hypothalamus [10] or the kidneys [11], nevertheless, more investigations are needed in order to confirm these hypotheses.

Investigating Aging and its Associated Diseases

Another important conceptual challenge is the gap that separates different biomedical research concentrations in spite of the similarities shared between them on a cellular and molecular levels. When it comes to aging, the physiology is well defined by a set of known hallmarks, that include among others, deregulated nutrient sensing, mitochondrial dysfunction, cellular senescence in addition to epigenetic alterations [12]. However, none of these factors are considered in diseases that increase exponentially with age, such as cancer, obesity, diabetes or cardiovascular diseases. To date, the fragile aging system does not have robust in vitro models to be used in the study of other diseases. While, in vivo models can be used in such studies, to the best of our knowledge, they have never been performed. Nevertheless, understanding the role that an aging system plays in disease development and progression can help shape the proposed medical interventions and present a first line of testing for various remedies that target them. For example, senescence associated secretory phenotype (SASP) has been shown to effect disease spread and impede the immune system [13,14]. While, metabolic dysfunction has been linked with several diseases, including cancer [15], neurological disorders [16] and some autoimmune diseases [17]. In fact, the role that SASP plays by inducing an inflammatory response, can be linked with the higher susceptibility to COVID 19 in the aging population [18]. Conversely, dietary remedies such as intermittent fasting and calorie restriction, have been shown to slow the rate of aging and are prescribed to alleviate several chronic conditions [19]. Lastly, rejuvenation and aging literature lack a stable and consistent quantitative measure of success. Thus, it is hard to differentiate between those that slow the aging process, rejuvenate or even reprogram the organ into a younger state altogether.

The Future of Rejuvenation Studies

While complete reversal on epigenetic level was only achieved using specific transcription factors that were able to reprogram the cell into a younger phenotype [20]. Such methods can only be used locally in order to control their impact. Moreover, stem cells, as well as transcription factors are highly susceptible to the systemic environment, which stresses the importance of implementing such techniques in younger age groups as a means of correcting the status of the disease and minimize the risks associated with the effect of aging associated circulating factors on them. Aging studies have managed to uncover key factors and achieve amazing results. Most importantly it succeeded in cracking the belief that aging is inevitable by identifying various methods to maintain a younger physiology longer. However, at this stage it is necessary to address the disease at its source, which can potentially alleviate the burden of several other diseases and maintain a healthier society.

References

1. Mahmoudi S, Xu L, Brunet A (2019) Turning back time with emerging rejuvenation strategies. Nature cell biology 21(1): 32-43.
2. Singh PB, Newman AG (2018) Age reprogramming and epigenetic rejuvenation. Epigenetics & chromatin 11(1): 1-7.
3. Lu Y, Brommer B, Tian X, Krishnan A, Meer M, et al. (2020) Reprogramming to recover youthful epigenetic information and restore vision. Nature 588(7836): 124-129.
4. López-Otín C, Blasco MA, Partridge L, Serrano M, Kroemer G (2013) The hallmarks of aging. Cell 153(6): 1194-1217.
5. Kang JS, Yang YR (2020) Circulating plasma factors involved in rejuvenation. Aging (Albany NY) 12(22): 23394-23408.
6. Rybtsova N, Berezina T, Kagansky A, Rybtsov S (2020) Can blood-circulating factors unveil and delay your biological aging? Biomedicines 8(12): 615.
7. Rebo J, Mehdipour M, Gathwala R, Causey K, Liu Y, et al. (2016) A single heterochronic blood exchange reveals rapid inhibition of multiple tissues by old blood. Nature communications 7(1): 13363.
8. Mehdipour M, Skinner C, Wong N, Lieb M, Liu C, et al. (2020) Rejuvenation of three germ layers tissues by exchanging old blood plasma with saline-albumin. Aging (Albany NY) 12(10): 8790-8819.
9. Basu A, Tiwari VK (2021) Epigenetic reprogramming of cell identity: lessons from development for regenerative medicine. Clinical Epigenetics 13(1): 1-11.
10. Kim K, Choe HK (2019) Role of hypothalamus in aging and its underlying cellular mechanisms. Mechanisms of ageing and development 177: 74-79.
11. Kassab A, Rizk N, Prakash S (2022) The Role of Systemic Filtrating Organs in Aging and Their Potential in Rejuvenation Strategies. International Journal of Molecular Sciences 23(8): 4338.
12. Keshavarz M, Xie K, Schaaf K, Bano D, Ehninger D (2023) Targeting the "hallmarks of aging" to slow aging and treat age-related disease: fact or fiction?. Molecular Psychiatry 28(1): 242-255.
13. Chambers ES, Akbar AN (2020) Can blocking inflammation enhance immunity during aging?. Journal of Allergy and Clinical Immunology 145(5): 1323-1331.
14. Ohtani N (2019) Deciphering the mechanism for induction of senescence-associated secretory phenotype (SASP) and its role in ageing and cancer development. The Journal of Biochemistry 166(4): 289-295.
15. Mili N, Paschou SA, Goulis DG, Dimopoulos MA, Lambrinoudaki I, et al. (2021) Obesity, metabolic syndrome, and cancer: pathophysiological and therapeutic associations. Endocrine p. 1-20.

16. Kazamel M, Stino AM, Smith AG (2021) Metabolic syndrome and peripheral neuropathy. Muscle & Nerve 63(3): 285-293.

17. Mok CC (2019) Metabolic syndrome and systemic lupus erythematosus: the connection. Expert Review of Clinical Immunology 15(7): 765-775.

18. Schmitt CA, Tchkonia T, Niedernhofer LJ, Robbins PD, Kirkland JL, et al. (2023) COVID-19 and cellular senescence. Nature Reviews Immunology 23(4): 251-263.

19. Bhoumik S, Yadawa AK, Srivastava P, Rizvi SI (2023) Intermittent Fasting as an Anti-Aging Strategy. In Emerging Anti-Aging Strategies Singapore pp. 191-206.

20. Wang H, Yang Y, Liu J, Qian L (2021) Direct cell reprogramming: approaches, mechanisms and progress. Nature Reviews Molecular Cell Biology 22(6): 410-424.

ISSN: 2574-1241

DOI: 10.26717/BJSTR.2023.50.007969

Amal Kassab. Biomed J Sci & Tech Res

Submission Link: https://biomedres.us/submit-manuscript.php