Biology of Aging: Paving the way for healthy aging

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« Biology of Aging: Paving the way for healthy aging »

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The world population is aging, and the number of elderly persons is increasing, especially those over 85 years. This unprecedented increase is not without putting a huge burden on the society, either from a health or social perspective. There may be several answers to the related challenges. One of the most basic approaches is to better understand the biology of aging as major means to prevent, influence or delay the appearance of chronic, aging-associated diseases. This would mean that elderly persons may expect to extend their healthspan in conjunction with the functionspan.

Indeed, these last years the biology of aging made huge progresses towards a better understanding of the basic biological mechanisms of aging and summed up this knowledge by announcing the nine hallmarks of aging (1). These are the fundamental biological aspects which collectively influence the aging process leading to various chronic diseases: genomic instability, telomere attrition, epigenetic alteration, defective protein metabolism (proteostasis), deregulated nutrient sensing, mitochondrial dysfunction, cellular senescence, stem cell exhaustion and altered intercellular communication. The description of these nine hallmarks do not preclude that there is a hierarchy among them, however from recent experimental data some of these hallmarks seem to be influencing more profoundly the biology of aging than the others. However, this picture may change in the future with the advancing of our understanding. Some of the major new directions in the biological research of aging are discussed/mentioned below.

Presently a huge experimental effort is put on studies elucidating the properties of senescent cells and the underlying process of cellular senescence (2), aiming to understand their biological and pathological role. During the last years the understanding that the senescent cells are not inert but are actively contributing to the inflamm-aging process by their senescence-associated secretory phenotype (3) made them the number one public target for attempts to modulate the biological aging process. The geroscience concept stating that because aging is the major risk factor for most non-genetic chronic diseases, an understanding of the role of aging in the onset of disease should open up new avenues for disease prevention and cures (4). Thus, in accordance with this concept, senescent cells should be eliminated, and a family of drugs dubbed senolytics is being developed (5). This approach is meant to intervene in the age-related diseases by modulating aging itself, here understood as an accumulation of senescent cells.

One other major progress through these last years was the establishment of the idea, and then at least partial experimental proving of the existence of an epigenetic clock, which