Is aging inevitable?

All animals, with very few exceptions, age. It has been difficult to provide a suitable evolutionary explanation for aging since natural selection, the driver of evolution, generally chooses animal traits that enhance fitness. Clearly aging would not qualify as a fitness-promoting process. To get around this conundrum, scientists have postulated that the strength of natural selection declines with age and as a result random genetic and tissue damage accumulate. Aging becomes the expression of this cumulative damage and if such damage could be prevented or fixed, an individual would not age. But, there are other explanations for the aging process. Every species has its own characteristic aging pattern and such an observation is difficult to account for if aging was the result of accumulated random damage. Plants, single cell animals like yeast and complex multicellular organisms like us all age. Aging is a developmental stage of the lifecycle just like embryogenesis and attainment of sexual maturity. As such, aging, like these other lifecycle stages, is underwritten by a developmental program. Each species has evolved its own aging program which would account for the observation that the aging pattern for each species is unique. Even though each species ages in a unique way, individuals within a given species do show variations in the aging pattern. For example, humans age differently than chimpanzees or whales but not all humans age identically. One's own personal observations confirm this fact. Some humans develop grey and white hair at a younger age than others and the same can be said about mobility problems and memory impairments. If aging is due to an evolved developmental program then aging must be an adaptive trait and aging is an inevitable lifecycle stage for all animals. To tease out the adaptive nature of aging, one must look at another feature of animals.

Animals do not live in isolation. All animals share an environmental space with a diverse community of other species. This community of species plus its environmental space is known as an ecosystem. Within an ecosystem, the diverse species interact with each other in a manner that is best for the ecosystem as a whole. Each species cannot be selfish and concerned only about its own needs. The function of each species is tuned into the function of the other species such that the ecosystem as a whole remains healthy. The health of an ecosystem requires that there be a diverse mix of species and that the population sizes of the species within the community be controlled. The best way to control the population sizes of species is to have aging underwritten by a developmental program. As animals age they become much more susceptible to dying. What is unique about our species is that we have developed an inherited cultural system. Our culture consists of a body of knowledge and practices that is modified by each generation and then the modified version is passed down to descendant generations. By virtue of our cultural practices, we have built complex cities which have now become our ecosystem, an urban ecosystem. Unlike natural ecosystems which contain a community of species interacting in a cooperative fashion, in our urban ecosystem we are the dominant species and the ecosystem is designed to optimize the function of our species only. Our inherited cultural system works in parallel with our inherited genetic system to drive human evolution including the developmental program underlying our aging pattern. This gene-culture co-evolution mechanism is unique to our species and is the primary driver of human evolution including the evolution of aging.

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