Extending the life span of animals and humans, only a matter of time

[1,2,3]I. Valentin Petrescu-Mag, [1,4]Tudor Păpuc

[1] SC Bioflux SRL, Cluj-Napoca, Romania; [2] Department of Environment and Plant Protection, Faculty of Agriculture, University of Agricultural Sciences and Veterinary Medicine Cluj-Napoca, Cluj-Napoca, Romania; [3] University of Oradea, Oradea, Romania; [4] Doctoral School of Agricultural Engineering Sciences, University of Agricultural Sciences and Veterinary Medicine, Cluj-Napoca, Romania. Corresponding author: T. Păpuc, ptudor2008@yahoo.com

A team of researchers at the MDI Biological Laboratory (Mount Desert Island, Hancock County, Maine, USA), in cooperation with researchers from the Buck Institute for Research on Aging in Novato, California (USA), and the Chinese University of Nanjing, have identified synergistic cellular pathways for longevity that extend life span fivefold in the well-known model for human diseases, *Caenorhabditis elegans* (Figure 1).

The nematode *C. elegans* is a valuable model in aging research because it shares many of its genes with humans and because its short lifespan of only 3-4 weeks allows scientists to quickly evaluate the effects of genetic and environmental influences on extending life span. In Figure 2, the morphology of the nematode in normal aging can be observed. Extension of life span observed experimentally in *C. elegans* would be the equivalent of a human living for 400-500 years (ScienceDaily, 8 January 2020). The study aims to understand the extension of life in good health conditions.

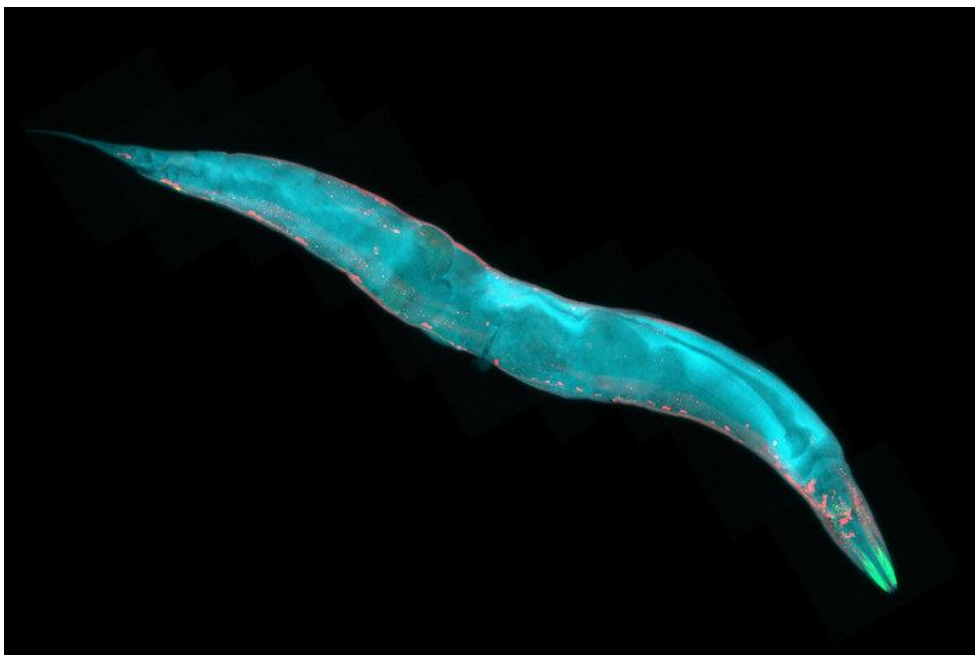

Figure 1. *Caenorhabditis elegans*, model organism for aging research (Source: ScienceDaily, 8 January 2020. Credit: heitipaves/Adobe Stock).

Figure 2. The normal aging of *Caenorhabditis elegans*: A – 2 days; B – 7 days; C – 13 days. (Source: Arjumand Ghazi, University of Pittsburgh School of Medicine, available at: https://www.wormatlas.org/aging/introduction/mainframe.htm)

As these metabolic pathways involved in the aging process are conserved throughout evolution, they have been the subject of extensive research in many animals. A number of drugs that extend the healthy lifespan by modifying these pathways are now in development. Discovering the synergistic effect of the different metabolic pathways involved opens the door to more effective anti-aging therapies than before (Lan et al 2019).

New research by Lan et al (2019) uses a double mutant organism in which insulin signaling (IIS) and TOR pathways have been genetically modified. As the modification of the IIS pathways produces a 100% increase in the life span and alteration of the TOR pathway produces a 30% increase in life span, the double mutant would be expected to live 130% longer. Unexpectedly, its life span was increased by 500%, which again shows that Mathematics is not always applicable in Biology.

Hermann Haller, M. D., president of the MDI Biological Laboratory, said: "Despite the discovery in *C. elegans* of cellular pathways that govern aging, it hasn't been clear how these pathways interact. [...] By helping to characterize these interactions, our scientists are paving the way for much-needed therapies to increase healthy lifespan for a rapidly aging population" (ScienceDaily, 8 January 2020).

The synergistic interaction of cell signaling pathways may also explain why scientists have not been able to identify a single gene responsible for the ability of some people to live well into old age without major age-related diseases (Lan et al 2019; ScienceDaily, 8 January 2020).

As the studies of the last ten years have suggested a causal link between the disruption of mitochondrial function and aging, the work of Lan et al (2019) focuses on how longevity is regulated in the mitochondria and which are the cellular organelles responsible for energy homeostasis.

The future research of the consortium presented above will focus on the further elucidation of the role of mitochondria in aging (ScienceDaily, 8 January 2020).

References

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*** https://www.wormatlas.org/aging/introduction/mainframe.htm

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Authors:
Ioan Valentin Petrescu-Mag, Department of Environmental Engineering and Protection, Faculty of Agriculture, University of Agricultural Sciences and Veterinary Medicine Cluj-Napoca, 3-5 Calea Mănăștur Street, 400372 Cluj-Napoca, Cluj County, Romania, European Union, e-mail: zoobiomag2004@yahoo.com
Tudor Păpuc, Doctoral School of Agricultural Engineering Sciences, University of Agricultural Sciences and Veterinary Medicine Cluj-Napoca, 3-5 Calea Mănăștur Street, 400372 Cluj-Napoca, Cluj County, Romania, European Union, e-mail: ptudor2008@yahoo.com

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